Project Manual

Bidding Documents

UNIVENT REPLACEMENT

At

Stony Point, Thiells, and West Haverstraw Elementary School
Stony Point Elementary School SED # 50-02-01-06-0-014-012
Thiells Elementary School SED # 50-02-01-06-0-025-018
West Haverstraw Elementary School SED # 50-02-01-06-0-024-015

North Rockland Central School District
65 Chapel Street
Garnerville, NY 10923

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03-04-25

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NOTICE TO BIDDERS

The BOARD of Education of the North Rockland Central School District (in accordance with section 103 of Article 5-a of the General Municipal Law) hereby invites the submission of sealed bids on:

BID NO.	ITEM	DUE DATE
	Univent Replacement at Stony Point, Thiells, and West Hav Elementary Schools	03-25-2025

SEALED BIDS will be received until 1:00 P.M. in the office of facilities, on the date specified above, at the North Rockland Central School District, 65 Chapel Street, Garnerville, NY 10923, at which time and place they will be publicly opened and read.

Bids will be received for contracts covering all work related to the Stony Point, Thiells, and West Haverstraw Elementary School Univent Replacement for the North Rockland Central School District, as described in the plans and specifications.

A site inspection and pre-bidders' conference has been scheduled promptly at 3.30 PM on the 10th day of March, at Stony Point Elementary School, 7 Gurnee Drive, Stony Point, NY, 10980. We will proceed to the other buildings from Stony Point.

Complete digital sets of Bidding Documents, drawings, and specifications, may be obtained online as a download at the following website: msa.biddyhq.com under 'public projects.'

Complete sets of Bidding Documents, Drawings and Specifications, may be obtained from Rev, 28 Church Street, Suite #7, Warwick, NY 10990 Tel: 845-651-3845, upon depositing the sum of $100.00 for each combined set of documents. Checks or money orders shall be made payable to North Rockland Central School District. Plan deposit is refundable in accordance with the terms in the Instructions to Bidders to all submitting bids. Any bidder requiring documents to be shipped shall make arrangements with the printer and pay for all packaging and shipping costs.

All questions are to be submitted to bidding@shilale.com. No questions will be entertained via telephone. Please refer to specification section 013101 Request for Information Form. Questions will be addressed via addenda.

All bid addenda will be transmitted to registered plan holders via email and will be available at msa.biddyhq.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.

Out to bid: 03-04-25
Pre-Bid walkthrough: 03-10-25 at 3:30 PM
Meet at Stony Point Elementary School
Bids due: 03-25-25 at 1 PM at North Rockland Central School District

AIA® Document A701™ – 2018

Instructions to Bidders

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

Sample

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

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

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.

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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.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, 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.)

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§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 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 days prior to the date for receipt of Bids.
(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 a Substitution Request Form if one 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.

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§ 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 four 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.

§ 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.

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.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, 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

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of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

§ 4.3.2 Paper copies of the Bid, the bid security, 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.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

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

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 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.)

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ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, 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 best interests.

§ 5.3.2 Unless otherwise prohibited by law, 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 lowest responsive and responsible 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 and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 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.

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ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 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 three days following the date of execution of the Contract. If the Work is to commence sooner 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 provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 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 to the bond 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 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)

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.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

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Additions and Deletions Report for
AIA® Document A701™ – 2018

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 14:50:40 ET on 10/14/2019.

PAGE 1

Sample

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Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, Michael Shilale, AIA, LEED, CPHC, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 14:50:40 ET on 10/14/2019 under Order No. 7102400339 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ - 2018, Instructions to Bidders, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

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SECTION 001200-SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

GENERAL

A. AIA Documents A701, 2018 Edition, "Instruction To Bidders", and its provisions, shall be considered an incorporated portion of Contract, unless specifically indicated to be omitted.

B. Where any Article of AIA A701, 2018 Edition, is modified by alteration, addition or deletion, provisions of such article shall remain in effect. All modifications shall be considered as added thereto. Where any such Article is amended, voided or superseded thereby, provisions of such Article not so specifically amended, voided or superseded shall remain in effect.

ARTICLE 1: DEFINITIONS

A. To paragraph 1.6, add the following: " For additional requirements refer to Specification Section 01230-ALTERNATES."

B. Add paragraph 1.10 as follows: " Where the term Architect or Engineer appears in the Documents, same refers to Michael R. Shilale Architects."

C. Add paragraph 1.11 as follows: " For the purpose of the Documents, where the term Contractor appears in the Documents, same refers to the successful Contractor."

ARTICLE 2: BIDDER'S REPRESENTATIONS

A. No modifications.

ARTICLE 3: BIDDING DOCUMENTS

3.1 COPIES

A. To subparagraph 3.1.1 delete the second sentence and replace with the following: "The deposit for each set will be refunded upon the return of the Contract Documents in good condition not later than thirty (30) days after the receipt of Bids."

B. To subparagraph 3.1.1 add the following: "For bidding Documents to be deemed in good condition, they must be returned bound as issued, legible and containing only the markings necessary for bidding purposes."

C. Add subparagraph 3.1.5 as follows: " Drawings and Project Manuals may be examined at the following locations:

1. Michael Shilale Architects, L.L.P
   140 Park Avenue
   New City, NY 10956

2. Office of Buildings and Grounds, NRSCD
   65 Chapel Street
   Garnerville, NY 10923

3. REVplans
   330 Route 17A
   Goshen, NY 10924

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

A. Add subparagraph 3.2.4 as follows: " In the absence of an interpretation by the Architect or Engineer, should the Drawings disagree in themselves or with the Specifications, the better quality, the more costly or the greater quantity of work or materials shall be estimated upon, and unless otherwise ordered, shall be furnished."

3.3 SUBSTITUTIONS

A. Add subparagraph 3.3.5 as follows: " In the Specifications, two or more kinds, types, brands, or manufacturers or materials are named, are regarded as the required standard of quality, and are presumed to be equal. The Contractor mat 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, when requested, and prior to the award of Contract, what kind, type, brand or manufacturer is included in the Base Bid for the specified item."

3.4 ADDENDA

A. To subparagraph 3.4.1 add the following: " All such Addenda shall become part of the Contract Documents and all Bidders shall be bound by such Addenda, whether or not received by the Bidders."

B. To subparagraph 3.4.3 delete this paragraph and replace with the following: " No Addenda will be issued later than two (2) working 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."

ARTICLE 4: BIDDING PROCEDURE

4.2 BID SECURITY

A. Add subparagraph 4.2.4 as follows: " 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 Certified Check or Bid Bond 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 his Bid for a period of forty five (45) days after the scheduled closing time for the receipts of Bids; and that if his Bid is accepted will enter into a formal contract with the Owner in accordance with the Form of Agreement included as part of the Contract Documents, and that the required Performance and Payment Bonds will be given; and that in the vent of the withdrawal of said Bonds within ten (10) days after he has received notice of the acceptance of his bid, the Bidder shall be liable to the Owner for the full amount of the Bid Guarantee as representing the damage to the Owner as result of the default of Bidder in any particular hereof."

B. Add subparagraph 4.2.5 as follows: " The Bid Securities shall be returned to all except the (3) three lowest Bidders within three (3) days after the formal opening of Bids. The remaining Bid Securities will be returned to the three (3) lowest Bidders within forty-eight (48) hours after the Owner and the accepted Bidder have executed the Contract and the executed Performance and Payment Bonds have been approved by the owner. If the required Contract and Bonds have not been executed within forty-five (45) days after the date of the opening Bids, then the Bond of any Bidder will be returned upon his request, provided he has not been notified of acceptance of his Bid prior to the date of such request.

4.4 MODIFICATION OR WITHDRAWAL OF BIDS

A. Delete subparagraph 4.4.1 as written and replace with the following: " A Bid may not be withdrawn, modified or canceled for a period of forty-five (45) days after the scheduled closing time for the receipt of Bids, and each Bidder so agrees in submitting a Bid."

ARTICLE 5: CONSIDERATION OF BIDS

5.3 ACCEPTANCE OF BID (AWARD)

A. To subparagraph 5.3.1 add the following: " The Owner may consider informal any Bid not prepared and submitted in accordance with all provisions of the Bidding Documents."

ARTICLE 6: POST-BID INFORMATION

6.3 SUBMITTAL

A. Add subparagraph 6.3.5 as follows: " For additional requirements refer to General Conditions AIA A201, paragraph 5.2 AWARD OF SUBCONTRACTS & OTHER CONTRACTS FOR PORTIONS OF THE WORK."

ARTICLE 7: PERFORMANCE BOND AND PAYMENT BOND

7.2 TIME OF DELIVERY AND FORM OF BONDS

A. To subparagraph 7.2.1 delete the first sentence and replace with the following: " The successful Bidder shall deliver the required Bonds to the Owner simultaneously with the executed Contract."

B. To subparagraph 7.2.2 add the following: " The Performance and Payment Bonds shall have as surety there under such surety company or companies as are acceptable to the 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."

ARTICLE 8: FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

A. No modifications.

Add " ARTICLE 9: SUPPLEMENTARY INSTRUCTIONS"

Add " 9.1 EXECUTION OF CONTRACT"

A. Add subparagraph 9.1.1 as follows: " Successful Bidder shall, within ten (10) days after notification of him that the Contract is ready for execution, execute in triplicate and deliver to Owner all executed counterparts of Contract in form set forth in the Contract Documents."

B. Add subparagraph 9.1.2 as follows: " Upon request by owner, successful Bidder shall, if corporation or an unincorporated association, file Certificate, evidencing fact that it is authorized to do business in the State of New York, or if conducting business under Assumed Name, file Count Clerk's Certificate to conduct business under such Assumed Name, and/or if conducting business as Partnership, file County Clerk's Certificate, evidencing filing with such Clerk of Certificate of Partnership."

C. Add subparagraph 9.1.3 as follows: " Simultaneously with their delivery of executed Contract, successful Bidders shall deliver copies of Certificate of Insurance (AIA Form G705, 1978) for insurance specified in the Contract Documents."

Add" 9.2 UNIT PRICES"

A. None at this time.

Add" 9.3 APPLICABLE STATE AND COUNTY SALES TAX"

A. Add subparagraph 9.3.1 as follows: " New York State & County Taxes: The Owner has stated that all materials

supplied in connection with the requirements of Work of this Contract are not subject to application of such Sales Tax. Should such Sales Taxes be imposed, Owner agrees that Contract Sum shall be increased by full amount of all such taxes."

END OF SECTION

SECTION 002100 – HIGHWAY LETTER

PART 1 - GENERAL

1.01 SUMMARY

A. The following information in this section is provided for informational purposes only and shall not become part of the contact documents.

1. Highway Letter dated 05-10-24

Michael Shilale, AIA, LEED, CPHC
John Cirilli, AIA, LEED

MICHAEL SHILALE ARCHITECTS, L.L.P.

140 Park Avenue ☐ New City, New York 10956 ☐ Tel 845-708-9200 ☐ Fax 845-708-9222 ☐ E-mail info@shilale.com

May 10, 2024

Charles H. Vezzetti
Highway Superintendent
Rockland County Highway Department
23 New Hempstead
New City, New York 10956

Re: Stony Point, Thiells, and West Haverstraw Elementary Schools Univent Replacement
Stony Point SED No. 50-02-01-06-0-014-012
Thiells SED No. 50-02-01-06-0-025-018
West Haverstraw SED No. 50-02-01-06-0-024-015

MSA Project No. 43040

Gentlemen:

On behalf of North Rockland Central School District and in conformance with the requirements of the New York State Education Department, we hereby notify you of the above referenced project.

The scope of work involves Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School at North Rockland Central School District. There are no proposed entries or exits on public highways and storm drainage will not be increased.

Complete sets of contract documents are available at the district office for review. If you should have any questions on the enclosed, please do not hesitate to contact our office.

Sincerely,

MICHAEL SHILALE ARCHITECTS, L.L.P

John P. Cirilli, AIA, LEED
Partner

cc: Michael Senno (NRCSD)
Michael R. Shilale, AIA, LEED, CPHC (MSA)

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PART 1 - GENERAL

1.01 GENERAL

A. Pursuant to, and in compliance with, your Advertisement for Bids and the Information to Bidders relative thereto and all of the Contract Documents, including any Addenda issued by the Architect and mailed to the undersigned prior to the opening Bids, whether received by the undersigned or not, we

_____
(CONTRACTOR NAME)

hereby proposes to furnish all plant, labor, supplies, materials, and equipment for Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School – General Construction, as required by and in strict accord with the applicable provisions of the Drawings and Specifications entitled "Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School – General Construction at North Rockland High School, 106 Hammond Rd, Thiells, NY 10984 for the North Rockland Central School District, 65 Chapel Street, Garnerville, NY 10923 ", all 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 prices:

1._____Dollars
(Write out in words)
(_____) Base Bid for all work.

_____ Consecutive Calendar Days for substantial completion _____with base bid.

The undersigned further proposes and agrees hereby to commence work with an adequate force and equipment immediately after being notified in writing to do so, and to achieve substantial completion for all work as required by the plans and specifications within the number of consecutive calendar days as itemized above.

Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School
– General Construction

Stony Point Elementary School
(If only this project is awarded to the General Contractor)
Total for Stony Point Elementary School ($_____)

Thiells Elementary School
(If only this project is awarded to the General Contractor)
Total for Thiells Elementary School ($_____)

West Haverstraw Elementary School
(If only this project is awarded to the General Contractor)
Total for West Haverstraw Elementary School ($_____)

Stony Point, Thiells, & West Haverstraw Elementary School
(If all projects are awarded to the General Contractor)
(Total Cost of all three projects is not required to equal sum of the
three individual projects and should reflect any savings of scale)
Total if all three projects are awarded to one contractor ($_____)

B. ALTERNATES

The undersigned further proposes and agrees that, should any of the following alternates be accepted and included in the Contract, the amount of the Base Bid, is hereto stated, shall be increased or decreased by the amounts indicated below.

Alternate No. 100 – For Stony Point Elementary School include ceiling replacement in areas where existing is called to be removed and reinstalled. See architectural demolition and reflected ceiling plans.

($_____)

Alternate No. 200 – For Theills Elementary School include ceiling replacement in areas where existing is called to be removed and reinstalled. See Architectural demolition and reflected ceiling plans.

($_____)

Alternate No. 300 – For West Haverstraw Elementary School include ceiling replacement in areas where existing is called to be removed and reinstalled. See architectural demolition and reflected ceiling plans.

($_____)

C. ALLOWANCES

The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents.

Allowance No. 101 – Contractor to include an allowance for the LF of Line set enclosure noted on the drawings. ($_____)

Allowance No. 106 – GC to include an allowance for front entry door and storefront replacement ($__80,000_____)

Allowance No. 201 – Contractor to include an allowance for the LF of Line set enclosure noted on the drawings. ($_____)

Allowance No. 301 – Contractor to include an allowance for the LF of Line set enclosure noted on the drawings. ($_____)

1.02 TIME OF COMPLETION

A. It is agreed by the undersigned that after receipt of Notice of Award and a consummation of a Contract Agreement in accord with the terms of the Contract Documents, he will start work on _____ 2025. Substantial completion will be _____, 2025. The punch list work will be completed by _____ 2025 and performed after school hours.

1.03 BID SECURITY

A. Attached hereto is Bid Security in the amount of five percent (5%) of the Base Bid.

1.04 UNIT PRICES

A. For work to be supplied or omitted at the price rate stipulated herein should the volume of work be increased, the following unit prices will be established as the limitations for such items of work, and each unit price shall include material, labor and services of each and everything necessary or required to complete for like work in kind, quality and function.

Unit Price No. 101 – Provide a unit price for the installation of 10 LF
Of line enclosure. (This amount will add or reduce allowance no. 101, 201, 301). ($_____)

Unit Price No. 104 – GC to provide a price to add or remove 100 SF of new 2 X 2
ACT ceiling. (This amount will add or reduce alternate no. 100, 200, 300). ($_____)

1.06 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 submit a bid for the purpose of restricting competition.

Resolved that _____
(Name of Individual)
be authorized to sign and submit the bid or proposal of this corporation for the following project
_____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 penalty of perjury.

The foregoing is a true and correct cop of the resolution by
_____
Corporation at a meeting of its Board of Directors held on the
_____day of_____, 20_____.

(SEAL OF THE CORPORATION)

_____
Secretary

1.07 ACCEPTANCE

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

1.08 AFFIRMS

A. The undersigned affirms and agrees that this Proposal is a firm one which remains in effect and will be irrevocable for a period of forty-five (45) days after opening of Bids.

1.09 TYPE OF BUSINESS

A. The undersigned hereby represents that it is a_____
(Corporation, Partnership, or an Individual). If a corporation, then the undersigned further represents that it is duly qualified as a corporation under laws of New York State and it is authorized to do business in this State.

1.10 PLACE OF BUSINESS

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

_____
(Name)

_____
(Address)

_____
(Telephone)

1.11 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.

1.12 ADDENDA

A. Any Addenda issued by the Architect and mailed or delivered to the undersigned prior to the Bid opening date shall become part of the Contract Documents. The Bidder shall enter on this list any addenda issued after this Form of Proposal has been received and shall fill in the addenda number and date.

Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____

1.13 ASBESTOS

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

(Sign Bid Here)

Dated_____, 20_____ _____
Legal Name of Person, Partnership or Corporation

By _____

Title _____

Address _____

_____

_____

PART 1 - GENERAL

1.01 GENERAL

A. Pursuant to, and in compliance with, your Advertisement for Bids and the Information to Bidders relative thereto and all of the Contract Documents, including any Addenda issued by the Architect and mailed to the undersigned prior to the opening Bids, whether received by the undersigned or not, we

_____
(CONTRACTOR NAME)

hereby proposes to furnish all plant, labor, supplies, materials, and equipment for Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School – Mechanical, as required by and in strict accord with the applicable provisions of the Drawings and Specifications entitled "Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School – Mechanical at North Rockland High School, 106 Hammond Rd, Thiells, NY 10984 for the North Rockland Central School District, 65 Chapel Street, Garnerville, NY 10923", all 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 prices:

1._____Dollars
(Write out in words)
(_____) Base Bid for all work.

_____ Consecutive Calendar Days for substantial completion _____with base bid.

The undersigned further proposes and agrees hereby to commence work with an adequate force and equipment immediately after being notified in writing to do so, and to achieve substantial completion for all work as required by the plans and specifications within the number of consecutive calendar days as itemized above.

Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School – Mechanical

Stony Point Elementary School
(If only this project is awarded to the Mechanical Contractor)
Total for Stony Point Elementary School ($_____)

Thiells Elementary School
(If only this project is awarded to the Mechanical Contractor)
Total for Thiells Elementary School ($_____)

West Haverstraw Elementary School
(If only this project is awarded to the Mechanical Contractor)
Total for West Haverstraw Elementary School ($_____)

Stony Point, Thiells, & West Haverstraw Elementary School
(If all projects are awarded to the Mechanical Contractor)
(Total Cost of all three projects is not required to equal sum of the three individual projects and should reflect any savings of scale)
Total if all three projects are awarded to one contractor ($_____)

B. ALTERNATES

The undersigned further proposes and agrees that, should any of the following alternates be accepted and included in the Contract, the amount of the Base Bid, is hereto stated, shall be increased or decreased by the amounts indicated below.

No alternates at the time.

C. ALLOWANCES

The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents.

Allowance No. 100 – Replace existing supply and return piping and insulation for 40 linear feet per each unit ventilator. ($_____)

Allowance No. 104 – Provide allowance to clean existing main ductwork for 20 linear fee per unit. ($_____)

Allowance No. 105 – Provide a proposal from a third-party HVAC commissioning agent. Contractor to include this amount in their base bid. Contractor will issue a credit Change order to the owner for the commissioning proposal among. Owner will contract directly with the commissioning agent. ($_____)

Allowance No. 200 – Replace existing supply and return piping and insulation for 40 linear feet per each unit ventilator. ($_____)

Allowance No. 204 – Provide allowance to clean existing main ductwork for 20 linear fee per unit. ($_____)

Allowance No. 205 – Provide a proposal from a third party HVAC commissioning agent. Contractor to include this amount in their base bid. Contractor will issue a credit Change order to the owner for the commissioning proposal among. Owner will contract directly with the commissioning agent. ($_____)

Allowance No. 300 – Replace existing supply and return piping and insulation for 40 linear feet per each unit ventilator. ($_____)

Allowance No. 304 – Provide allowance to clean existing main ductwork for 20 linear fee per unit. ($_____)

Allowance No. 305 – Provide a proposal from a third party HVAC commissioning agent. Contractor to include this amount in their base bid. Contractor will issue a credit Change order to the owner for the commissioning proposal among. Owner will contract directly with the commissioning agent. ($_____)

1.02 TIME OF COMPLETION

A. It is agreed by the undersigned that after receipt of Notice of Award and a consummation of a Contract Agreement in accord with the terms of the Contract Documents, he will start work on _____, 2025. Substantial completion will be _____, 2025. The punch list work will be completed by _____, 2025 and performed after school hours.

1.03 BID SECURITY

A. Attached hereto is Bid Security in the amount of five percent (5%) of the Base Bid.

1.04 UNIT PRICES

A. For work to be supplied or omitted at the price rate stipulated herein should the volume of work be increased, the following unit prices will be established as the limitations for such items of work, and each unit price shall include material, labor and services of each and everything necessary or required to complete for like work in kind, quality and function.

Unit Price No. 100 – Provide a unit price to replace additional existing supply and return piping and insulation. Price per 10 linear feet. (This amount will add or reduce allowance no. 100, 200, 300). ($_____)

1.06 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 submit a bid for the purpose of restricting competition.

Resolved that _____
(Name of Individual)
be authorized to sign and submit the bid or proposal of this corporation for the following project _____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 penalty of perjury.

The foregoing is a true and correct cop of the resolution by
_____
Corporation at a meeting of its Board of Directors held on the
_____day of_____, 20_____.

(SEAL OF THE CORPORATION)

_____
Secretary

1.07 ACCEPTANCE

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

1.08 AFFIRMS

A. The undersigned affirms and agrees that this Proposal is a firm one which remains in effect and will be irrevocable for a period of forty-five (45) days after opening of Bids.

1.09 TYPE OF BUSINESS

A. The undersigned hereby represents that it is a_____
(Corporation, Partnership, or an Individual). If a Corporation, then the undersigned further represents that it is duly qualified as a Corporation under laws of New York State and it is authorized to do business in this State.

1.10 PLACE OF BUSINESS

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

_____
(Name)

_____
(Address)

_____
(Telephone)

1.11 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.

1.12 ADDENDA

A. Any Addenda issued by the Architect and mailed or delivered to the undersigned prior to the Bid opening date shall become part of the Contract Documents. The Bidder shall enter on this list any addenda issued after this Form of Proposal has been received and shall fill in the addenda number and date.

Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____

1.13 ASBESTOS

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

(Sign Bid Here)

Dated_____, 20_____ _____
Legal Name of Person, Partnership or Corporation

By _____

Title _____

Address _____

_____

_____

PART 1 - GENERAL

1.01 GENERAL

A. Pursuant to, and in compliance with, your Advertisement for Bids and the Information to Bidders relative thereto and all of the Contract Documents, including any Addenda issued by the Architect and mailed to the undersigned prior to the opening Bids, whether received by the undersigned or not, we

_____
(CONTRACTOR NAME)

hereby proposes to furnish all plant, labor, supplies, materials and equipment for Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School, as required by and in strict accord with the applicable provisions of the Drawings and Specifications entitled "Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School – Electrical at 106 Hammond Rd, Thiells, NY 10984 for the North Rockland Central School District, 65 Chapel Street, Garnerville, NY 10923 ", all 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 prices:

1._____Dollars
(Write out in words)
(_____) Base Bid for all work.

_____ Consecutive Calendar Days for substantial completion _____with base bid.

The undersigned further proposes and agrees hereby to commence work with an adequate force and equipment immediately after being notified in writing to do so, and to achieve substantial completion for all work as required by the plans and specifications within the number of consecutive calendar days as itemized above.

Univent Replacement at Stony Point, Thiells, and West Haverstraw Elementary School
– Electrical Construction

Stony Point Elementary School
(If only this project is awarded to the Electrical Contractor)
Total for Stony Point Elementary School ($_____)

Thiells Elementary School
(If only this project is awarded to the Electrical Contractor)
Total for Thiells Elementary School ($_____)

West Haverstraw Elementary School
(If only this project is awarded to the Electrical Contractor)
Total for West Haverstraw Elementary School ($_____)

Stony Point, Thiells, & West Haverstraw Elementary School
(If all projects are awarded to the Electrical Contractor)
(Total Cost of all three projects is not required to equal sum of the
three individual projects and should reflect any savings of scale)
Total if all three projects are awarded to one contractor ($_____)

B. ALTERNATES

Alternate No. 100 – For Stony Point Elementary School include lighting replacement in areas where existing is called to be removed and reinstalled. See architectural demolition and reflected ceiling plans.

($_____)

Alternate No. 200 – For Theills Elementary School include lighting replacement in areas where existing is called to be removed and reinstalled. See Architectural demolition and reflected ceiling plans.

($_____)

Alternate No. 300 – For West Haverstraw Elementary School include lighting replacement in areas where existing is called to be removed and Reinstalled. See architectural demolition and reflected ceiling plans.

($_____)

C. ALLOWANCES

Allowance No. 102 – Provide allowance for the relocation of 40 electrical devices that require relocation due to new UV size. ($_____)

Allowance No. 103 – Electrical contractor to provide new power connections to 10 existing UV locations (per building) where existing cannot be reused. ($_____)

Allowance No. 202 – Provide allowance for the relocation of 40 electrical devices that require relocation due to new UV size. ($_____)

Allowance No. 203 – Electrical contractor to provide new power connections to 10 existing UV locations where existing cannot be reused. ($_____)

Allowance No. 302 – Provide allowance for the relocation of 40 electrical devices that require relocation due to new UV size. ($_____)

Allowance No. 303 – Electrical contractor to provide new power connections to 10 existing UV locations where existing cannot be reused. ($_____)

1.02 TIME OF COMPLETION

A. It is agreed by the undersigned that after receipt of Notice of Award and a consummation of a Contract Agreement in accord with the terms of the Contract Documents, he will start work on _____ 2025. Substantial completion will be _____2025. The punch list work will be completed by _____ 2025 and performed after school hours.

1.03 BID SECURITY

A. Attached hereto is Bid Security in the amount of five percent (5%) of the Base Bid.

1.04 UNIT PRICES

Unit Price No. 102 – Electrical Contractor to provide a unit price to relocate an existing electrical device that is required to be relocated. Price per 1 device. (This amount will add or reduce Allowance No. 102, 202, 302).

($_____)

Unit Price No. 103 – Electrical Contractor to provide new power connection to existing UV location where existing feeder cannot be reused. Price per 1 feed. (This amount will add or reduce allowance no. 103, 203, 303).

($_____)

1.06 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 submit a bid for the purpose of restricting competition.

Resolved that _____
(Name of Individual)
be authorized to sign and submit the bid or proposal of this corporation for the following project _____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 penalty of perjury.

The foregoing is a true and correct cop of the resolution by
_____
Corporation at a meeting of its Board of Directors held on the
_____day of_____, 20_____.

(SEAL OF THE CORPORATION)

_____
Secretary

1.07 ACCEPTANCE

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

1.08 AFFIRMS

A. The undersigned affirms and agrees that this Proposal is a firm one which remains in effect and will be irrevocable for a period of forty-five (45) days after opening of Bids.

1.09 TYPE OF BUSINESS

A. The undersigned hereby represents that it is a_____
(Corporation, Partnership, or an Individual). If a Corporation, then the undersigned further represents that it is duly qualified as a Corporation under laws of New York State and it is authorized to do business in this State.

1.10 PLACE OF BUSINESS

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

_____
(Name)

_____
(Address)

_____
(Telephone)

1.11 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.

1.12 ADDENDA

A. Any Addenda issued by the Architect and mailed or delivered to the undersigned prior to the Bid opening date shall become part of the Contract Documents. The Bidder shall enter on this list any addenda issued after this Form of Proposal has been received and shall fill in the addenda number and date.

Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____
Addendum #_____	Dated_____

1.13 ASBESTOS

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

(Sign Bid Here)

Dated_____, 20_____ _____
Legal Name of Person, Partnership

or Corporation

By _____

Title _____

Address _____

_____

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

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

OWNER:
(Name, legal status and address)

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)
S

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

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

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

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Init.
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User Notes: (1215575923)

Signed and sealed this day of ,

	(Principal) *(Seal)*
(Witness)	*(Title)*
	(Surety) *(Seal)*
(Witness)	*(Title)*

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User Notes: (1215575923)

Additions and Deletions Report for
AIA® Document A310™ – 2010

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 11:52:13 on 06/28/2010.

PAGE 1

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User Notes: (1215575923)

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, Michael Shilale, AIA, LEED, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 11:52:13 on 06/28/2010 under Order No. 3379937681_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A310™ – 2010, Bid Bond, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

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User Notes: (1215575923)

SECTION 003126 – EXISTING HAZARDOUS MATERIAL INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

A. The following information in this section is provided for informational purposes only and shall not become part of the contract documents.
   1. Bulk Sample Results – Stony Point
   2. XRF LBP Testing Results – Stony Point
   3. Professional's Letter and Certification – Stony Point
   4. Bulk Sample Results – Thiells
   5. XRF LBP Testing Results – Thiells
   6. Professional's Letter and Certification - Thiells
   7. Bulk Sample Results – West Haverstraw
   8. XRF LBP Testing Results – West Haverstraw
   9. Professional's Letter and Certification – West Haverstraw

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Fibrous Concrete Reinforcement: Section 032101.

1.03 **REFERENCES**

A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of American Concrete Institute (ACI) and American Society for Testing and Materials (ASTM) documents.
   1. ACI 117-10: Specifications for Tolerances in Concrete Construction and Materials
   2. ACI 212.3R-10:Report on Chemical Admixtures for Concrete; Chapter 15 Permeability Reducing Admixtures
   3. ACI 301-16: Specification for Structural Concrete for Buildings.
   4. ACI 305R-10: Guide for Hot Weather Concreting.
   5. ACI 306R-10: Guide to Cold Weather Concreting.
   6. ACI 308.1-11: Standard Specification for Curing Concrete.
   7. ASTM C 494/C 494M - 11: Standard Specification for Chemical Admixtures for Concrete.

1.04 **SUBMITTALS**

A. Submittals Package: Submit product data for design mix(es) and materials for concrete specified below at the same time as a package.

B. Product Data:
   1. Mix Design: Submit proposed concrete design mix(es) together with name and location of batching plant at least 28 days prior to the start of concrete work.
      a. Include test results of proposed concrete proportions based on previous field experience or laboratory trial batches in accordance with ACI 301, Section 4.
      b. Pumped Concrete: Include test results of proposed design mix(es) tested under actual field conditions with the maximum horizontal run and vertical lift required for this project.
   2. Portland Cement: Brand and manufacturer’s name.
   3. Fly Ash: Name and location of source, and DOT test numbers.
   4. Air-entraining Admixture: Brand and manufacturer’s name.
   5. Water-reducing Admixture: Brand and manufacturer’s name.

6. Aggregates: Name and location of source, and DOT test numbers.
7. Lightweight Coarse Aggregates: Brand and manufacturer's name.
8. Chemical Hardener (Dustproofing): Brand and manufacturer's name, and application instructions.
9. Chemical Curing and Anti-Spalling Compound: Brand and manufacturer's name, and application instructions.
10. Bonding Agent (Adhesive): Brand and manufacturer's name, and preparation and application instructions.
11. Expansion Joint Fillers: Brand and manufacturer's name.
12. Emery Aggregate: Brand and manufacturer's name, and application instructions.

C. Quality Control Submittals:
1. Batching Plant Records: At the end of each day of placing concrete, furnish the Director's Representative with a legible copy of all batch records for the concrete placed.
2. Concrete Pumping Equipment Data: Include manufacturer's name and model of principal components, type of pump, and type and diameter of pipe/hose.
3. Minutes of the previous pre-installation conference.

D. LEED Design Submittals:
1. MR Credit 4.1 and MR Credit 4.2: Identify manufacturer's name, the percentage of post-consumer recycled content by weight, the pre-consumer recycled content by weight, and the cost of the product.
2. MR Credit 5.1 and MR Credit 5.2: Identify source, cost, and the fraction by weight that is considered regional.

1.05 QUALITY ASSURANCE

A. Concrete batching plant shall be currently approved as a concrete supplier by the New York State Department of Transportation.

B. Fly ash supplier shall be currently approved as a fly ash supplier by the New York State Department of Transportation.

C. Certifications: Affidavit by the bar reinforcement manufacturer certifying that bar material meets the contract requirements.
1. Submit evidence consisting of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement.
a. Documentation to confirm compliance with General Conditions Article 25.4 Domestic Steel.
2. Fabricator's and Erector's Qualifications Data: Name and experience of fabricator and erector.

D. The Contractor agrees, that if the value of this contract exceeds $100,000 all structural steel, reinforcing steel and other major steel items to be incorporated in the Work of this Contract shall be produced and made in whole or substantial part in the United States, its territories or possessions.

E. Source Quality Control: The Director reserves the right to inspect and approve the following items, at his own discretion, either with his own forces or with a designated inspection agency:
1. Batching and mixing facilities and equipment.
2. Sources of materials.

PART 2 PRODUCTS

2.01 MATERIALS (Amendments to ACI 301, Section 4, for Normal Weight Concrete and Section 7, for Lightweight Concrete):

A. Cement: ASTM C 150, Type I or II Portland cement.

B. Water: ASTM C94 and Potable

C. Air-entraining Admixture: ASTM C 260

D. Mid-Range Water-reducing Admixture: ASTM C 494/C 494M, Type A

E. High Range Water-reducing Admixture (Superplasticizer): ASTM C 494/C 494M, Type F

F. Corrosion-Inhibiting Admixture: ASTM C 494/C 494M, for use in resisting corrosion of steel reinforcement.

G. Retarding Admixture: ASTM C 494, Type D, Water-reducing and retarding, for use in hot weather concreting.

H. Accelerating Admixture: Non-corrosive admixture, containing no chloride, complying with ASTM C 494, Type C or E

I. High Range Water-reducing and Retarding Admixture: ASTM C 494, Type G

J. Fly Ash: ASTM C 618, Class F

K. Fine Aggregates: ASTM C33

L. Normal Weight Aggregates: ASTM C33, 3/4” maximum

M. Lightweight Aggregates: ASTM C 330

N. Moisture-Retaining Cover: Waterproof paper, polyethylene film, or polyethylene-coated burlap complying with ASTM C 171.

O. Chemical Curing and Anti-Spalling Compound: ASTM C-309, Type 1D, Class B, with a minimum 18 percent total solids content. No thinning of material allowed.
1. SureCure Emulsion, Kaufman Products, Inc. 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.
2. Cure & Seal by Symons Corp., 200 East Touhy Ave., PO Box 5018, Des Plaines, IL 60017-5018, (847) 298-3200.

3. MasterKure CC 180 WB by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.
4. Cure & Seal 25 UV (J-22 UV) by Dayton Superior Corp., 1125 Byers Rd.,., Miamisburg, OH 45342, (800) 745-3700.
5. Acrylseal HS by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.

P. Chemical Hardener (Dustproofing): Colorless aqueous solution of magnesium-zinc fluosilicate.
1. MasterKure HD 300WB by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990..
2. Surfhard by The Euclid Chemical Co., 19218 Redwood Rd., Cleveland, OH 44110, (216) 531-9222.
3. Liqui-Hard by W.R. Meadows, Inc., PO Box 543, Elgin, IL 60121, (847) 683-4500.
4. FluoHard by L & M Construction Chemicals, Inc., 14851 Calhoun Rd., Omaha, NE 68152, (402) 453-6600.
5. Armortop by Anti Hydro International, Inc., 265 Badger Ave., Newark, NJ 07108, (800) 777-1773.
6. Diamond by Kaufman Products , Inc., 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.

Q. Type 1 Expansion Joint Filler: Preformed, resilient, nonextruding cork units complying with ASTM D 1752, Type II.

R. Epoxy Bonding Agent (Adhesive): 100 percent solids epoxy-resin-base bonding compound, complying with ASTM C 881, Types I, II, IV and V, Grade 2 (horizontal areas) or Grade 3 (overhead/vertical areas), and Class B (40-60 degrees Fahrenheit) or Class C (60 degree Fahrenheit and above).

1. SurePoxy HM Series by Kaufman Products, Inc., 3811 Curtis Avenue, Baltimore, MD 21226, (800) 637-6372.
2. Sikadur Hi-Mod 32 by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071, (800) 933-7452.
3. MasterEmaco ADH 327 RS by by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.

S. Emery Aggregate: Natural emery, crushed, polyhedral in shape, with not more than 10 percent flat or elongated pieces, properly screened, graded and packaged in the manufacturer's plant, and delivered to the Site in sealed, labeled packages.
1. Emerundum by Anti Hydro International, Inc., 265 Badger Ave., Newark, NJ 07108, (800) 777-1773.
2. Non-Slip Aggregate by Setcon Industries, Inc., 5 Mathews Ave., Riverdale, NJ 07457-1020, (201) 283-0500.
3. MasterTop 120SR by Master Builders/ BASF Building Systems, 23700 Chagrin Blvd., Cleveland, OH 44122, (800) 628-9990.

2.02 **PROPORTIONING OF MIXES**

A. Cast-in-place concrete shall be air-entrained normal weight concrete except where lightweight concrete is indicated on the drawings.

1. Normal weight concrete shall have a minimum compressive strength as specified on the drawings.
   a. Slump: Maximum 4 inches; minimum 2 inches before the addition of any water-reducing admixtures or high-range water-reducing admixtures (superplasticizers) a maximum of 6 inches after the addition of mid-range water-reducing admixture, and a maximum of 8 inches after addition of high range water reducing admixture.
2. Optional Material: Fly ash may be substituted for (Portland) cement in normal weight and lightweight concrete at 15 percent to 25 percent by weight of the required minimum (Portland) cement. If fly ash is incorporated in a concrete design mix, make necessary adjustments to the design mix to compensate for the use of fly ash as a partial replacement for (Portland) cement.
   a. Adjustments shall include the required increase in air-entraining admixture to provide the specified air content.
   b. Lower early strength of the concrete shall be considered in deciding when to remove formwork.

3. Lightweight concrete shall be air-entrained concrete, comply with the requirements of ACI 211 and ACI 301, and have a minimum compressive strength as indicated on the drawings. Lightweight concrete shall be made with normal fine aggregate; lightweight fine aggregate shall not be used.
   a. Dry unit weight shall not exceed 116 pounds per cubic foot and not be less than 110 pounds per cubic foot.
   b. Slump: Maximum 4 inches; minimum 1 inch before the addition of any water-reducing admixtures or high-range water-reducing admixtures (superplasticizers), a maximum of 6 inches after the addition of mid-range water-reducing admixture, and a maximum of 8 inches after addition of high range water reducing admixture.

B. Slump for Pumped Concrete: When a water-reducing admixture is not used, maximum slump shall be 4 inches. When a water-reducing admixture is used, maximum slump shall be 6 inches and when a high-range water-reducing admixture (superplasticizers) is used, maximum slump shall be 8 inches.

C. Design Air Content: Design air content shall be 5 percent for air-entrained concrete with an allowable tolerance of plus or minus 1.5 percent for total air content, 3” maximum for non-air entrained concrete, and 4 percent minimum for light weight concrete. Use air-entraining admixture, not air-entrained cement.

D. Water-Cement Ratio: Cast-in-place concrete shall have a maximum water-cement ratio as indicated on the drawings.

E. Admixtures: Do not use admixtures in concrete unless specified or approved in writing by the Engineer.

2.03 **PRODUCTION OF CONCRETE**

A. Provide ready-mixed concrete, either central-mixed or truck-mixed, unless otherwise approved in writing by the Engineer.

B. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.
   1. In cold weather, comply with ACI 306R.
      a. When air temperature is below 40 degrees F (4 degrees C) heat the mixing water and, if necessary, the aggregates to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees C) at point of placement. If the mixing water is heated, do not exceed a temperature of 140 degrees F at the time it is added to the cement and aggregates.
   2. In hot weather, comply with ACI 305R.
      a. When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Do not use items of aluminum for mixing, chuting, conveying, forming or finishing concrete, except magnesium alloy tools may be used for finishing.

B. Check items of aluminum required to be embedded in the concrete and insure that they are coated, painted or otherwise isolated in an approved manner.

C. Install waterstops in accordance with manufacturer's printed instructions.

D. Hardened concrete, reinforcement, forms, and earth which will be in contact with fresh concrete shall be free from frost at the time of concrete placement.

E. Do not deposit concrete in water. Keep excavations free of water by pumping or by other approved methods.

F. Prior to placement of concrete, remove all hardened concrete spillage and foreign materials from the space to be occupied by the concrete.

3.02 ADMIXTURE ADDITIONS AT THE SITE

A. Site additions shall be limited to high-range water-reducers, non-chloride accelerators, and corrosion inhibitors. Comply with manufacturers' printed instructions for discharge of admixtures shall be furnished.

B. High-Range Water-Reducers:

1. Concrete shall arrive at a slump of 2 to 4 inches (50 to 100 mm). Water additions at the Site shall be limited to comply with water-to-cementitious ratio requirements.
2. Following addition of high-range water-reduced concrete, a minimum of 70 revolutions or 5 minutes of mixing shall be completed to assure a consistent mixture.

C. All concrete with other admixture additions shall mix a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.

3.03 FINISHING FORMED SURFACES

A. Finish Schedule: Except where indicated otherwise on the Drawings, provide the finishes below:
1. Rough Form Finish for concrete surfaces not exposed to view.
2. Smooth Form Finish for concrete surfaces exposed to view.

3.04 SLABS

A. Slabs On Grade: Provide key type joints unless otherwise shown. Tool exposed joints.

B. Finish Schedule: Except where indicated otherwise on the Drawings, provide the finishes below:
1. Floated Finish for:
   a. Treads and platforms of exterior steps and stairs.
   b. Slabs and fill over which waterproofing, roofing, vapor barrier, insulation, terrazzo, or resin bound flooring is required.
2. Troweled Finish for:
   a. Interior slabs that are to be exposed to view.
   b. Slabs and fill over which resilient wood flooring, resilient tile or sheet flooring, carpet, or thin-film coating system is required.
   c. Slabs and fill over which thin-set ceramic tile is required, except fine-broom finished surface.
   d. Treads and platforms of interior steps and stairs.
3. Scratched Finish for:
   a. Surfaces to be covered with ceramic tile set in a bonded thick mortar bed, except screed to a Class B tolerance.
   b. Surfaces to be covered with floor topping.

C. Exposed surfaces with fibrous reinforcement: After curing of the concrete, remove any protruding fibers in a manner which will not harm the parent concrete.

D. Floor flatness and levelness tolerances: For flatness and levelness tolerances of floor slabs refer to ACI 302 Chapter 10.1. Floor surface tolerances shall be 1/8 inch over a horizontal distance of 10 feet in any direction, unless otherwise specified by floor profile quality classifications in ACI 302.

1. When flatness or levelness tolerances are not met then the floor shall be ground or scarified and repoured to meet specifications.

3.05 CURING AND PROTECTION

A. Hot Weather Concreting: Comply with ACI 305R whenever the atmospheric temperature or the form surface temperature is at or above 90 degrees F., or climatic conditions of wind and/or low humidity will cause premature drying of the concrete.

B. Curing Temperature: Maintain the temperature of the concrete at 50 degrees F. or above during the curing period. Keep the concrete temperature as uniform as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceeds 5 degrees F. in any one hour and 50 degrees F. in any 24-hour period.

C. Curing and Moisture Mitigation for Resilient Flooring:
1. Acceptable curing and drying conditions include a minimum ambient temperature of 70 degrees F and a maximum relative humidity of 50%.
   a. Air movement at 15 mph.
2. Do not cure slabs by adding water; ponding or wet burlap method.
3. Do not use curing compounds or cure-and-seal materials unless such use is approved in writing by the adhesive and floor covering manufacturers. The curing product manufacturer's conformance to ASTM C 1315 is not a substitute for the adhesive and floor covering manufacturer's approval.
4. Cure the slab by covering with waterproof paper, plastic sheets, or a combination of the two for 3 to 7 days.

3.06 CHEMICAL HARDENER (DUSTPROOFING)

A. Apply chemical hardener to all troweled finished interior floors which are to be left exposed.

B. Do not apply chemical hardener until concrete has cured the number of days recommended in manufacturer's instructions.

C. Prepare surfaces and apply chemical hardener in accordance with manufacturer's printed instructions and recommendations.

3.07 FIELD QUALITY CONTROL (Amendments to ACI 301, Section 1):

A. Make available to the Director's Representatives whatever test samples are required to make tests. Furnish shipping boxes for compression test cylinders.

END OF SECTION

EQUIVALENCY

It is the intent of these specifications to allow approved equals for all materials specified where brand name, trade name, catalog reference, or patented commodity is referenced. References to such specific commodities are intended as descriptive, not restrictive, unless otherwise stated. Comparable products will be considered if proof of comparability is provided, including appropriate catalog excerpts, descriptive literature, specifications and list data, etc. The District architect/engineer's decision as to the acceptance of the product as equal will be final.

_____
Officer of Company

_____
Date

_____
Company Name

_____
Telephone

_____
Address

North Rockland School District

65 Chapel Street
Garnerville, NY 10923

REFERENCE FORM

All work described shall be performed by an established contractor, which must document its ability to perform the contract in a timely, competent, and acceptable manner. Before the award is made, this contracting firm must submit proof to the Owner's satisfaction that it:

1. Has performed projects of a similar type at a minimum of 3 schools in the past three years.
2. Has been trained by the manufacturer for specific equipment in the proper installation of their equipment.
3. Is not a private residence.
4. Is fully equipped with spare parts and service vehicles to render proper service.
5. Has the ability to fully complete the entire project by the completion date specified elsewhere in the contract specifications.
6. Is able to respond to an emergency in 24 hours or less.

All bidders will be required to complete this form providing three references of past performance. References should involve projects and/or service situations of similar size and scope to bid this. References must have had dealings with the Bidder within the last thirty-six (36) months. The District reserves the right to contact any or all of the references supplied for an evaluation of past performance in order to establish the responsibility of the Bidder before the actual award of the bid and/or contract. Completion of the reference form is required.

BIDDER'S NAME: _____

DATE FILED: _____

OFFICER'S NAME: _____

REFERENCE'S NAME: _____

ADDRESS: _____

_____

TELEPHONE: _____

REFERENCE'S NAME: _____

ADDRESS: _____

_____

TELEPHONE: _____

REFERENCE'S NAME: _____

ADDRESS: _____

_____

TELEPHONE: _____

REFERENCE'S NAME: _____

ADDRESS: _____

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TELEPHONE: _____

REFERENCE'S NAME: _____

ADDRESS: _____

_____

TELEPHONE: _____

REFERENCE'S NAME: _____

ADDRESS: _____

_____

TELEPHONE: _____

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:

§ 1.3.2 State of incorporation:

§ 1.3.3 President's name:

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

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

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

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User Notes: (1989523515)

§ 1.3.4 Vice-president's name(s)

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

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

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

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

§ 2. LICENSING

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

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

§ 3. EXPERIENCE

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

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

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

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

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

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

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

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

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

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

§ 4. REFERENCES

§ 4.1 Trade References:

§ 4.2 Bank References:

§ 4.3 Surety:

§ 4.3.1 Name of bonding company:

§ 4.3.2 Name and address of agent:

§ 5. FINANCING

§ 5.1 Financial Statement.

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

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

Net Fixed Assets;

Other Assets;

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

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

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

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

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

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

§ 6. SIGNATURE

§ 6.1 Dated at this day of

Name of Organization:

By:

Title:

§ 6.2

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

Subscribed and sworn before me this day of 20

Notary Public:

My Commission Expires:

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Additions and Deletions Report for
AIA® Document A305™ – 1986

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 17:06:52 on 08/30/2005.

PAGE 4

Subscribed and sworn before me this day of ~~20~~ 20___

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(1989523515)

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, Michael Shilale, AIA, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 17:06:52 on 08/30/2005 under Order No. 1000150197_1 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A305™ – 1986 - Contractor's Qualification Statement, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

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AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

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

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

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

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

Sample

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

The Owner and Contractor agree as follows.

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

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

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

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

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

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(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

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

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 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.

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

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

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

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

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

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§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

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

§ 5.2 Final Payment

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

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

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

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

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§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

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

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
.3 AIA Document A201™–2017, General Conditions of the Contract for Construction
.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

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

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

Init.
/
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[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

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

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

Init.
/

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Additions and Deletions Report for
AIA® Document A101™ – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 15:01:06 on 12/22/2017.

PAGE 1

Sample

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Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, Michael Shilale, AIA, LEED, CPHC, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 15:01:06 on 12/22/2017 under Order No. 1200144258 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A101™ - 2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

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AIA® Document A101™ – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the day of in the year
(In words, indicate day, month and year.)

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

Sample

THE OWNER:
(Name, legal status and address)

THE CONTRACTOR:
(Name, legal status and address)

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

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

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

TABLE OF ARTICLES

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

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§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:
(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss	Sub-Limit

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:
(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage	Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.
(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to

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the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

[ ] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

[ ] **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

[ ] **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

[ ] **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

[ ] **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

[ ] **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

[ ] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

[ ] **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

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[ ] **§ A.2.5.2 Other Insurance**

(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than ($) each occurrence, ($) general aggregate, and ($) aggregate for products-completed operations hazard, providing coverage for claims including

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
.2 personal injury and advertising injury;
.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
.4 bodily injury or property damage arising out of completed operations; and
.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

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.1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.

.2 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.

.3 Claims for bodily injury other than to employees of the insured.

.4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.

.5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.

.6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.

.7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.

.8 Claims related to roofing, if the Work involves roofing.

.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.

.10 Claims related to earth subsidence or movement, where the Work involves such hazards.

.11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than ($) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than ($) each accident, ($) each employee, and ($) policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than ($) per claim and ($) in the aggregate.

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§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.
(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[ ] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:
(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

[ ] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than ($) per claim and ($) in the aggregate, for Work within fifty (50) feet of railroad property.

[ ] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than ($) per claim and ($) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

[ ] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

[ ] **§ A.3.3.2.5** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

[ ] **§ A.3.3.2.6 Other Insurance**
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:
(Specify type and penal sum of bonds.)

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Type	Penal Sum ($0.00)
Payment Bond	100% of Construction Value
Performance Bond	

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

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Additions and Deletions Report for

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PAGE 1

Sample

PAGE 7

Payment Bond	100% of Construction Value

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SAMPLE INSURANCE REQUIREMENTS – CAPITAL CONSTRUCTION

1. Notwithstanding any terms, conditions or provisions, in any other writing between the parties, the contractor hereby agrees to effectuate the naming of the District/BOCES as an Additional Insured on the contractor's insurance policies, except for workers' compensation and N.Y. State Disability insurance.

2. The policy naming the District as an Additional Insured shall:

   a. Be an insurance policy from an A.M. Best A- rated or better insurer, licensed to conduct business in New York State. A New York licensed and admitted insurer is strongly preferred. The decision to accept non-licensed and non-admitted carriers lies exclusively with the District/BOCES and may create significant vulnerability and costs for the District/BOCES.

   b. State that the organization's coverage shall be primary and non-contributory coverage for the District/BOCES, its Board, employees and volunteers with a waiver of subrogation in favor of the District/BOCES.

   c. Additional insured status shall be provided by standard or other endorsements that extend coverage to the District/BOCES for on-going operations (CG 20 38) and products and completed operations (CG 20 37). The decision to accept an endorsement rests solely with the District/BOCES. A completed copy of the endorsements must be attached to the Certificate of Insurance.

3. a. The certificate of insurance must describe the services provided by the contractor (e.g., roofing, carpentry or plumbing) that are covered by the liability policies.

   b. At the District's/BOCES' request, the contractor shall provide a copy of the declaration page of the liability and umbrella/excess policies with a list of endorsements and forms. If requested, the contractor will provide a copy of the policy endorsements and forms.

   c. There will be no coverage restrictions and/or exclusions involving New York State Labor Law statutes or gravity related injuries.

   d. 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. Policy exclusions may not be accepted.

4. The contractor agrees to indemnify the District/BOCES for applicable deductibles and self-insured retentions.

5. Minimum Required Insurance:

a. **Commercial General Liability Insurance**
$1,000,000 per Occurrence/$2,000,000 Aggregate
$2,000,000 Products and Completed Operations
$1,000,000 Personal and Advertising Injury
$100,000 Fire Damage
$10,000 Medical Expense
The general aggregate shall apply on a per-project basis.

b. **Owners Contractors Protective (OCP) Insurance**
For projects less than or equal to $1,000,000 and work on 1 story (10 feet) only; $1 million per occurrence, $2 million aggregate with the District/BOCES as the Named Insured.

For projects greater than $1,000,000 and/or work over 1 story (10 feet); $2 million per occurrence, $4 million aggregate with the District/BOCES as the Named Insured.

For all projects where General Liability, Auto and Umbrella/Excess Coverage is with non-licensed and non-admitted carriers in New York State; $2 million per occurrence, $4 million aggregate with the District/BOCES as the named Insured.

The District/BOCES will be the Named Insured on OCP Policies. There will be no Additional Insureds on any OCP Policies.

c. **Automobile Liability**
$1,000,000 combined single limit for owned, hired, borrowed and non-owned motor vehicles.

d. **Workers' Compensation and NYS Disability Insurance**
Statutory Workers' Compensation (C-105.2 or U-26.3); and NYS Disability Insurance (DB-120.1) for all employees. Proof of coverage must be on the approved specific form, as required by the New York State Workers' Compensation Board. ACORD certificates are not acceptable. A person seeking an exemption must file a CE-200 Form with the state. The form can be completed and submitted directly to the WC Board online.

e. **Builder's Risk**
Must be purchased by the contractor to include interest of the Owner and Contractor jointly in a form satisfactory to the owner. The limit must reflect the total completed value – all material and labor costs and provide coverage for fire, lightning, explosion, extended coverage, vandalism, malicious mischief, windstorm, hail and/or flood.

f. **Umbrella/Excess Insurance**
$5 million each Occurrence and Aggregate for general construction and no work at elevation (1 story – 10 feet) or project values less than or equal to $1,000,000.

$10 million each Occurrence and Aggregate for high-risk construction, work at elevation (>1 story or 10 feet) or project values greater than $1,000,000.

Umbrella/Excess coverage shall be on a follow-form basis over the Auto Liability and General Liability coverages.

6. Contractor acknowledges that failure to obtain such insurance on behalf of the District/BOCES constitutes a material breach of contract and subjects it to liability for damages, indemnification and all other legal remedies available to the District/BOCES. The contractor is to provide the District/BOCES with a certificate of insurance, evidencing the above requirements have been met, prior to the commencement of work.

7. **Subcontractors are subject to the same terms and conditions as stated above and must submit same to the District/BOCES for approval prior to the start of any work.**

8. In the event the General Contractor fails to obtain the required certificates of insurance from the Subcontractor and a claim is made or suffered, the Contractor shall indemnify, defend, and hold harmless the District/BOCES, its Board, employees and volunteers from any and all claims for which the required insurance would have provided coverage**. This indemnity obligation is in addition to any other indemnity obligation provided in the Contract.**

ADDITIONAL REQUIREMENTS ASBESTOS, LEAD ABATEMENT AND/OR HAZARDOUS MATERIALS

Asbestos/Lead Abatement/Pollution Liability 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/BOCES 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/BOCES.

SECTION 05121
STRUCTURAL STEEL

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish and erect all structural steel as shown on Drawings.

B. Provide shop painting and galvanizing as specified.

1.02 RELATED SECTIONS

A. Metal Fabrications.....Section 05500

B. Painting.....Section 09900

1.03 SUSTAINABILITY REQUIREMENTS (NOT USED)

1.04 REFERENCES

References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

A. American Society of Testing and Materials (ASTM) standards, latest editions.

B. "Specification for Structural Steel Buildings" - American Institute of Steel Constructors (AISC 360-05).

C. American Welding Society (AWS) standards for procedures and materials.

D. "Code of Standard Practice for Steel Buildings and Bridges" (AISC 303)

E. Steel Structures Painting Council (SSPC) standards.

1.05 DEFINITIONS

A. Structural Steel

Structural Steel consists of the steel elements of the structural steel frame essential to support the design loads. These elements consist of material as shown on the structural steel plan and listed in Article 2.1 of the AISC "Code of Standard Practice for Steel Buildings and Bridges." Structural steel also includes structural lintels framing over masonry openings bearing on masonry.

1.06 SUBMITTALS

A. Product Data

Submit manufacturers' specifications for the following products:

1. Primer paint, galvanizing repair paint

2. Expansion/adhesive anchors

B. Shop Drawings

1. Failure to submit legible shop drawings will be cause for return without review.

2. Provide a set of shop drawings showing all connections, bolting, welding, and size of material. Shop drawing shall show intended method of reinforcing existing members and making connections to existing steel as developed by the detailer based on conditions and actual dimensions. Shop Drawings for MEP equipment dunnage and access platforms shall not be submitted until after approval of the submitted MEP units. Ensure shop drawings submitted for MEP equipment dunnage and access platforms are coordinated and based on unit approved, which may vary substantially from the Basis of Design. The Contractor shall take into account in their schedule the potential time impact in the sequencing of the steel drawings.

3. Do not order steel in advance of approval of shop drawings, except at own risk.

4. Shop drawings shall be prepared under supervision of and bear the seal of a Professional Engineer licensed in the State of New York. Connections not designed on the Drawings shall be done by the detailer’s licensed Engineer. Do not submit unchecked shop drawings. After final approval of all shop drawings, submit a final set sealed and signed by the Professional Engineer.

5. Shop drawings will be checked for size of material and strength of connection by the Engineer of Record, which shall not render the Engineer of Record responsible for any errors in construction dimensions, etc. that have been made in preparation of shop drawings. The Contractor shall assume full responsibility for the correctness of dimensions and fit.

6. Calculations shall be submitted upon request.

7. After shop drawings are 100% complete and approved and all field changes have been made, submit a set of as-built drawings to the Authority.

C. Quality Control Submittals

1. Certificates and Affidavits

a. Furnish bolt manufacturer's test reports, covering physical and chemical tests, for each lot of high strength bolts submitted.

b. Furnish steel manufacturer's certificate certifying welders employed on the Work are current with their AWS qualifications (including having their required maintenance forms from their employer) and for work performed in the field are NYC licensed welders as per §28-407.1 of the Administrative Code.

c. Furnish complete listing of ASTM's of materials listed in Part 2 of this Section and certification that materials supplied meet those listed.

d. For mechanical and adhesive anchors installed in concrete, submit ICC certification for use in cracked concrete.

2. Contractor Qualifications

Provide proof of Fabricator, Erector, Adhesive Anchor Installer and Zinc Metallizer qualifications specified under “Quality Assurance”.

a. Provide proof of Zinc Metallizer’s qualifications specified under “Quality Assurance”; certification of qualifications meeting Military Standard by one of the following:

1) A branch of the U.S. Dept. of Defense (DoD), or

2) A company certified by U.S. Dept. of Defense; submit DoD certification for this company.

3) The Society for Protective Coatings (SSPC).

D. Test Reports

Submit test reports for zinc metallizing and epoxy coating system as specified herein, paragraph titled “Galvanizing by the Zinc Metallizing Process”.

E. Sustainability Submittals

1. Recycled Content

a. Submit documentation of recycled content of structural steel; product data or manufacturer’s statement as applicable.

1.07 QUALITY ASSURANCE

A. Qualifications

1. Fabricator: Company specializing in the fabrication of steel products to be used in this Contract shall have a minimum of five years experience.

2. Erector: Company specializing in performing the Work of this Section shall have a minimum of three years experience and have done at least three projects with similar quantity of material.

3. Adhesive Anchor Installer: Installer for adhesive anchors installed in a horizontal or upwardly inclined position supporting sustained tension loads shall be certified per Appendix D9.2.2 of ACI 318-11/paragraph 17.8.2.2 of ACI 318-14.

B. Regulatory Requirements

1. Building Code: Work of this Section shall conform to all requirements of the NYC Building Code and all applicable regulations of governmental authorities having jurisdiction, including safety, health, noise, and anti-pollution regulations. Where more severe requirements than those contained in the Building Code are given in this Section, the requirements of this Section shall govern.

2. New York City Board of Standards and Appeals (BSA): Rules for Arc and Gas Welding and Oxygen Cutting and Steel Covering the Specifications for Design, Fabrication, and Inspection of Arc and Gas Welded Steel Structures and Qualification of Welders and Supervisors.

3. Industry Standards: Standards specified in Article 1.04 apply to Work of this Section. Where more severe requirements then those contained in the Standards are given in this Section or the Building Code, requirements of this Section or the Building Code shall govern.

4. Recommendations or suggestions in the codes and references listed in this Article and under “References” shall be deemed to be mandatory unless they are in violation of the Building Code.

C. Certifications

1. Structural steel shall conform to the material acceptance, certification, and inspection require-ments of Section BC 1701.

2. Qualify welding processes and welding operators in accordance with AWS B2.1.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site at such intervals as to insure uninterrupted progress of Work.

B. Deliver anchor bolts and other anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay Work.

C. Store materials to permit easy access for inspection and identification. Store material of the ground and protect from the weather and contamination.

1.09 FIELD MEASUREMENTS

A. Take field measurements as required by Drawings. Where possible, take field measurements of existing conditions prior to fabrication. Verify that field measurements are the same as those shown on Drawings and shop drawings. Report all deviations to the Authority in writing.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Paint

1. Tnemec Co.
2. Carboline
3. Sherwin Williams
4. Zinckote

B. Expansion/Screw/Adhesive Anchors, Fasteners

1 Hilti, Inc.
2. ITW Buildex/Red Head/Ramset
3. Simpson Strong-Tie Anchor System, Columbus, OH
4. Dewalt
5. ALllfasteners

2.02 MATERIAL

A. Structural Steel Shapes, Shims, Plates, and Bars

1. Structural steel shall conform to the provisions of ASTM A36 or ASTM A992, pipe steel to the provisions of ASTM A53, Grade B, and tube steel to the provisions of ASTM A500, Grade B, unless otherwise noted.
2. Structural steel shall contain a minimum of 30% post-consumer content and 15% pre-consumer content.

B. Bolts

1. Anchor Bolts: Shall conform to the provisions of ASTM F1554, Grade 36, unless different grade is specified elsewhere. Size and detailing indicated on Drawings.
2. Unfinished Bolts: Shall conform to the provision of ASTM A307.

3. High-Strength Bolts: Shall conform to the requirements of ASTM F3125-Grade A325/F1852.

4. Expansion/Screw/Adhesive Anchors, Fasteners Provide types as indicated on Drawings. The anchor specified shall be considered the basis of design. As a minimum, all anchors exposed to weather or embedded in masonry are to be Type 316 stainless steel. Anchors installed in concrete shall be ICC certified for cracked concrete as per BC 1913.

   a. Wedge Expansion and Undercut Anchors/ expansion bolts shall have an ICC-ES Evaluation Service Report (ESR) issued in accordance with ACI 355.2 or ICC-ES AC 193 for use in cracked concrete, and including seismic applicability loading, and pursuant to the Office of Technical Certification and Research (OTCR) Building Bulletin 2014-018. Anchors installed in grouted masonry shall have a report issued in accordance with AC 01.

   b. Adhesive anchors shall have an ICC-ES Evaluation Service report (ESR) issued in accordance with ACI 355.4 or ICC-ES AC 308 and for use in cracked concrete, and seismic loading and pursuant to the Office of Technical Certification and Research (OTCR) Building Bulletin 2014-018. Anchors installed in grouted masonry shall have a report issued in accordance with AC 58.

   c. Concrete Screw Anchors shall have an ICC-ES Evaluation Service report (ESR) issued in accordance with ICC-ES AC 193 and for use in cracked concrete, and seismic loading and pursuant to the Office of Technical Certification and Research (OTCR) Building Bulletin 2014-019. Anchors installed in grouted masonry shall have a report issued in accordance with AC 106.

D. Hardware

1. Nuts for anchor bolts and unfinished bolts shall conform to the requirements of ASTM A563.

2. Nuts for high-strength bolts shall conform to the provisions of ASTM A194 or ASTM A563.

3. Washers shall conform to the provisions of ASTM F436.

E. Filler Metal for Welding

1. Welding electrode shall conform to E70XX classi- fication of AWS A5.1 for welding of new steel to new steel.

2. Welding electrode shall be compatible with existing steel where connections are made to steel of existing building. Electrode shall be E7018 unless determined otherwise. E7018 are low hydrogen electrodes that must be kept extremely dry.

F. Structural Steel Primer Paint

Provide type of primer indicated on steel under the following application conditions.

1. General application shop primer:

   a. Shop Primer Paint: Modified alkyd rust-inhibitive type containing no lead equal to Tnemec 10-99 or Carboline Carbocoat 115-SG.

   b. Field Touch-up Paint: Acrylic rust-inhibitive type containing no lead equal to Tnemec 115 Unibond or Carboline Carbocrylic 3358. Paint must meet SCAQMD standards for VOC emissions.

2. Primer for zinc metallized steel: Epoxy paint equal to Tnemec Co. Series FC27 Typoxy or Carboline Carboguard 888.

3. Steel embedded in exterior masonry wall and exterior application: High adhesion high-solids epoxy coating equal to Tnemec Co. Series 135 Chembuild or Carboline Carboguard 890. This paint shall also be used on the existing steel exposed by masonry removals and wherever else existing steel is to be painted. Top coats for exposed to view steel is to be the epoxy coat system given in Section 09900.

G. Galvanizing by the Hot-dip Method – No Finish Coating

1. Galvanize structural shapes in accordance with ASTM A123.

2. Galvanize hardware in accordance with ASTM A153.

3. Galvanizing repair paint for regalvanizing welds and damaged areas shall conform to ASTM A780 and be VOC compliant, such as Zinckote Galvanizing Paint.

2.03 SHOP ASSEMBLY - FABRICATION

A. General

1. Do not fabricate until shop drawings have been reviewed.

2. Fabricate and assemble steel in shop to greatest extent possible. Fabricate items and assemblies in accordance with AISC Specifications and the shop drawings. Properly mark members for field assembly.

B. Shop Connections

1. Weld or high-strength bolt shop connections as indicated on Drawings.

2. High-strength bolt connections are friction (slip-critical) connections. Install high-strength bolts in accordance with Specification for Structural Joints using High Strength Bolts (approved by the Research Council on Structural Connections (RCSC) – 2009). Utilize Class A connections. If steel surface of connection area is prepared to SSPC-SP5 surface preparation, Class B may be utilized pending

inspection by the Authority's Special Inspection lab that surface meets the required preparation. Pay all costs to the Authority incurred for this inspection.

3. Welding: Comply with "Structural Welding Code" for procedures, appearance, and quality of welds and methods used in correcting welded work.

4. Holes for other Work

a. Provide holes and openings required for securing other Work to steel framing and for passage of other Work through framing members. Coordinate with Drawings of other Work.

b. Cut, drill, flame cut, or punch holes perpendicular to metal surfaces. Method of cutting must not produce a roughness of over 1000 microinches. Surfaces exceeding these limits must be repaired by machine grinding. Reinforce all openings with steel shapes as shown on shop drawings.

C. Shear Stud Connectors (Non-Metal Deck Construction)

1. Weld shear studs to beams with automatically timed stud welding equipment at spacing shown on Drawings. Size, type, and length specified on Drawings.

2. Top flanges of beams must be free of paint, heavy rust, millscale, dirt, ice and/or water, and any other material that will interfere with the welding operation.

2.04 SHOP PAINTING

A. General

Apply one shop coat of primer paint on structural steel except as follows:

1. Steelwork or portions of such to receive sprayed fireproofing. Steel that is exposed to the cavity and within the block back-up is to be painted, unless indicated to be galvanized.

2. Top flanges of structural steel members requiring stud shear connectors or supporting metal deck.

3. Contact surfaces of structural steel that are to be bolted or welded together and surfaces within 2" of field welds.

4. Steel members, hardware, and miscellaneous pieces to be galvanized and not specified or indicated to be painted.

B. Cleaning and Surface Preparation

1. Clean all steel first in accordance with SSPC-SP1.

2. Clean steel work not to be painted (except steel work to be galvanized) in accordance with SSPC-SP2.

3. Clean new steel work to be painted within the same day as it will be applied and in accordance with SSPC-SP3 for interior steel and SSPC-SP6 for exterior steel.

C. Shop Coat

1. Apply structural steel primer paint for interior application at a rate to provide dry film thickness of 2.0 to 3.5 mils. Apply primer paint for embedded in exterior masonry wall and exterior application at a rate to provide dry film thickness of 7.0 to 9.0 mils. Provide full coverage of joints, corners, edges, and exposed surfaces. Apply to dry surfaces only, when surface temperatures are above dew-point, by brush, spray, or roller, thoroughly and evenly, in strict accord with manufacturer's instructions for every detail of handling.

2. Apply second coat of the approved primer, in a darker shade, to surfaces inaccessible to painting after assembly or erection.

3. Protect machined surfaces with an approved rust-inhibiting coating that is readily removable prior to erection.

2.05 GALVANIZING

A. General

Galvanize all steel exposed to the weather and other members designated on Drawings to receive it. Galvanize all lintels, attachment clips, shims**,** and hardware.

B. Cleaning and Surface Preparation

1. Hardware (bolts, nuts, etc.): Clean and leave free of mill scale before galvanizing.

2. Clean all steel first in accordance with SSPC-SP1 if needed.

3. Steel members: Clean in accordance with SSPC-SP8 before hot-dip galvanizing.

4. Steel members: Clean in accordance with SSPC-SP10 before zinc metallizing. Surface shall have a 3-4 mil anchor pattern. Moisture cannot be present on steel and temperature cannot be less than 5^{o}F above the dew point. Thermal spray must be applied within 4 hours of blasting.

C. Shop Coat - Hot-dip Galvanizing Only – Provide for items not to have finish paint coat.

1. Galvanize hardware in accordance with ASTM A153.

2. Galvanize steel shapes, including shims, in accordance with ASTM A123. Apply zinc coating as per Thickness Grade specified in ASTM A123.

2.06 SOURCE QUALITY CONTROL

A. Testing

1. General

a. Structural steel work is subject to all tests required by the Special Inspection requirements of the 2014 NYC Building Code.

b. Cooperate with the Testing Laboratory in making all required tests.

2. Tests: To be performed by the Authority's Testing Laboratory.

a. Shop bolted connections: Tested in accordance with AISC specifications.

b. Shop welding - The laboratory will perform the following functions:

1) Certify welders.

2) Visually inspect all welds, record type and locations of defects, and perform tests if necessary. Check all corrected work.

3) Perform non-destructive tests if necessary or as required by the Special Inspector.

B. Inspection

1. Testing Laboratory

a. The Authority will engage a Testing Laboratory or Special Inspection Agency to assist in the inspection of steel fabrication and conduct tests at the mill, shop, or foundry. The laboratory will assist in checking erection tolerances and provide shop and field testing required for all structural steel and metal deck work, including metal deck and studs.

b. The Testing Laboratory will be responsible to and under the supervision of a Special Inspector.

2. Special Inspector

The Authority will assign, under the requirements of Section BC 1704.3, a Special Inspector to supervise the Work listed above under "Testing Laboratory".

3. Notification: Notify the Authority before beginning fabrication of the structural steel and supply laboratory with copies of agreements, approved drawings, approved prints of all shop details, etc., and all necessary information relating thereto. Do not ship material to job site until after inspection and approval by the Testing Laboratory.

4. Discretionary Inspections: No mill, shop, foundry, or field inspection, such as is above provided for, shall be held to prohibit or preclude inspection of such materials during delivery and erection at the building by such other persons as the Authority shall direct.

5. Reports: Shop and field reports, including shipments, will be submitted by the Testing Laboratory to the Authority as the work proceeds at the shop or job site. A final report will be submitted by the Testing Laboratory when work is completed at the shop, and again when work is completed in the field. The Special Inspector reserves right to reject material not in compliance with specified requirements at any time.

6. Corrections: Correct deficiencies in work which inspections and tests have indicated to not be in compliance with requirements. Pay for additional tests, at own expense, necessary to reconfirm any non-compliance of original work and as necessary to show compliance of corrected work.

7. Contractor's Responsibility: Inspection and acceptance or failure to inspect shall in no way relieve the Contractor or the mill and shops from their responsibility to furnish satisfactory material strictly in accordance with Drawings and Specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and that erection may proceed. Notify the Authority in writing of conditions that adversely affect the Work. Do not proceed with erection until conditions have been corrected. Beginning of installation means the erector accepts existing conditions.

3.02 ERECTION

A. General

1. Erection shall conform to Sections BC 2205.3.3 and BC 3305.2.

2. All work shall be erected plumb, square, and true to lines and levels in strict accordance with the structural requirements of the building.

3. Provide all machinery, apparatus, and staging required for the erection of steel work in a thoroughly safe and efficient manner. Install, maintain and remove, without injury to other Work, such temporary bracing, scaffolding, etc. as may be necessary or required. Care shall be taken that no part of the structure is overloaded during construction.

4. Arrange for deliveries of material to facilitate the rapid and continuous progress of operation, but the site or streets adjacent to same shall not be used for the storage of material unless absolutely necessary and then only with special permission of the Authority and other authorities having jurisdiction.

5. Employ a Licensed Professional Engineer and Land Surveyor to ensure accurate erection of the steel.

6. Do not alter or cut structural members without written approval of the Engineer of Record. Flame cutting in field of members to correct fabrication errors is to be avoided and to be done only upon approval of the Engineer of Record based on the method proposed. Roughness cannot exceed 1000 microinches. Repair of surfaces shall be by mechanical grinding.

B. Temporary Shoring and Bracing

Provide temporary shoring and bracing members with connections of sufficient strength to bear erection loads and guy wires to maintain structure plumb and in true alignment until completion of erection. Remove temporary work when permanent members and bracing are in place and final connections are made. Fill erection bolt-holes on exposed to view members with plug welds and grind smooth.

C. Anchor Bolts

1. Furnish to the concrete masons anchor bolts and other connectors required for securing structural steel to cast-in-place concrete work, together with instructions, templates, etc. necessary for setting them. Anchor bolts are to be surveyed and any approved modifications made prior to placement of columns.

2. For post-installed expansion/screw/adhesive anchors, drill holes of depth and size required by the manufacturer for the required loading. Holes shall be cleaned completely using wire brush and compressed air following manufacturer's guidelines. For installation in existing substrates not installed as part of the Work, have bolt manufacturer perform pullout test in each substrate to verify capacity and quality of substrate prior to final approval of anchor to be utilized.

3. Tighten anchor bolts after support members have been positioned and plumbed. Cut off protruding edges of wedges or shims flush with edge of base or bearing plate prior to packing with grout. Tighten expansion bolts/anchors to torque required by manufacturer.

D. Base Plates

1. Clean concrete and masonry bearing surfaces of loose and bond-reducing materials.

2. Set loose and attached base plates and bearing plates for structural members on shims and other adjusting devices. Plates are to have grout holes, such as leveling plates, within specified tolerances. Elevations of shims and leveling plates shall be surveyed and adjusted to correct elevation prior to placement of column or beam. Plates are to have grout holes.

3. Grouting under plates is part of the Work of Section 03610. Grouting is to be done prior to placement of any concrete on the structure.

E. Field Assembly

1. Erect structural frames accurately to lines and elevations indicated. Align and adjust members forming a part of a complete frame or structure before permanently fastening.

2. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly.

3. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

4. Level and plumb individual members of structure within specified AISC tolerances.

5. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

6. Splice members only where indicated and accepted on shop drawings.

F. Connections

1. Field connections between new steel members will typically be bolted unless otherwise indicated on Drawings. Connections made to existing steel shall be welded utilizing E7018 electrode. Follow preheat and interpass temperature requirements given in AWS.

   a. Provide high-strength bolts for bolted connections except where unfinished bolts are indicated on the Drawings. High-strength bolt connections are friction (slip-critical) connections. Install high-strength bolts in accordance with "Specification for Structural Joints using High Strength Bolts."

   b. Provide unfinished bolts where indicated on Drawings. Lock nuts by upsetting bolt end or by similar method when unfinished bolts are not encased in concrete. Tighten all bolts and nuts fully.

   c. For ASTM A307 bolts, hardened washer shall be installed under the turned element. For ASTM F3125, Grade A325,/F1852 bolts, hardened washers shall be installed in accordance with Section 6.2 of "Specification for Structural Joints using High Strength Bolts."

   d. Expansion/screw/adhesive anchors shall be installed in accordance with the manufacturer’s installation instructions. Holes shall be cleaned completely using wire brush and compressed air following manufacturer’s guidelines. Tighten to the torque values specified by the manufacturer. Attach plates flush with surfaces after the surfaces have been cleaned. Have bolt manufacturer perform pullout test in each substrate to verify capacity and quality of substrate prior to final approval of anchor to be utilized.

2. Holes

a. The size of bolt holes shall be in accordance with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings."

b. Ream holes that must be enlarged to admit bolts. Burning or use of drift pins is not permitted.

G. Lintels

Erect all exterior steel lintels and relieving angles, connecting steel to members using new clip angles, or other structural member required to match the existing conditions. Shim angles/steel supports to their contract position for proper and plumb installations of masonry.

H. Field Touch-Up

1. Painted Members: After erection, clean all damaged areas in shop coat, exposed surfaces of bolts, bolt heads, nuts and washers, abrasions, and all field welds and unpainted areas adjacent to field welds to the same standards as the shop coat and paint with field touch-up primer paint to same thickness as the shop coat. These areas shall be thoroughly cleaned of rust and other bond inhibiting materials before applying the touch-up paint. Paint all existing steel using the high-solids epoxy specified in Part 2. Finish painting is specified in Section 09900. Provide epoxy coat system for all exterior painting.

2. Galvanized Members: After erection, clean and paint all damaged areas to the galvanizing, welds, and areas adjacent to welds with the galvanizing repair paint. For galvanized members to be painted, finish painting is specified in Section 09900 and shall be the final two coats of the epoxy paint system.

3.03 TOLERANCES

A. Erection tolerances shall be in accordance with "Code of Standard Practice for Steel Buildings and Bridges".

3.04 FIELD QUALITY CONTROL

A. The Contractor shall cooperate with the Special Inspector and the Testing Laboratory performing Special Inspection testing by providing adequate notification for when work is performed that will require the inspection and provide all required access and means for the laboratory to perform the inspection and testing.

B. The Special Inspector will:

1. Review erection of structural framework and test field bolting and welding as listed in Part 2 of this Section.

2. Where post-installed anchors are utilized, perform Special inspection on Post-installed anchors as per BC 1705.37. Adhesive anchors installed in concrete in a

horizontal or upwardly inclined position supporting sustained tension loads shall be installed under continuous Special Inspection as required by Appendix D9.2.4 of ACI 318-11/paragraph 17.8.2.4 of ACI 318-14.

C. The Contractor shall engage an engineer licensed in the state of New York to check tolerances and inspect the erection.

3.05 CLEANING

A. Structural steel or portions of such to receive sprayed fireproofing shall be clean of dust, grease, oils, loose material, and any other matter which would impair the adhesion of the fireproofing material to the steel.

END OF SECTION

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:		_____
1. Primer paint, repair paint		
2. Stud shear connectors		
3. Expansion/adhesive anchors		
Shop Drawings:		_____
1. Steel shop drawings		
2. Calculations		
Certificates:		_____
1. Steel affidavit		
2. Bolt test reports		
3. Welders qualifications & license		
4. Material listing		
5. ICC Certification for Mechanical/Adhesive Anchors		
Qualifications		_____
1. Fabricator		
2. Erector		
3. Adhesive anchor installer		

* * *

SECTION 05310

FLUTED STEEL DECKS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Structural Steel: Section 051200

B. Field Touch-up Painting: Section 099101

C. Sustainable Design Requirements: Section 018113

1.3 REFERENCES

A. Comply with the following reference standards unless otherwise shown or specified:
   1. Design: "Specification for the Design of Cold-Formed Steel Structural Members" by the American Iron and Steel Institute (AISI Specification).
   2. Welding: "Structural Welding Code - Sheet Steel, AWS D 1.3", by the American Welding Society (AWS Code).

1.4 SUBMITTALS

A. Shop Drawings: Show application to project. Prepare separate drawings, coordinated with, but not superimposed on, joist drawings or structural steel erection drawings.

B. Welding Certificates: Copies of certificates for welding procedures and personnel.

C. Product Data: Manufacturer's printed specifications and installation instructions.

D. Recycled Content: Submit product data confirming recycled content for LEED Credit

E. Environmental Product Declaration (EPD): Submit Environmental Product Declaration (EPD) for LEED Credit

1.5 HANDLING AND STORAGE

A. Handle and stack materials carefully in order to prevent deformation or damage. During unloading and hoisting, take extra care to prevent damage to ends and sides of individual metal deck panels. Do no place panels in direct contact with the ground. Protect panels from the elements and keep panels dry.
   1. If mud, dirt, or other foreign matter is accumulated on panels, remove such accumulation completely prior to installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Roof Deck: Sheet steel conforming to ASTM A 653, Grade 33. Before fabrication, sheet steel shall receive ASTM A653, Class G 90, hot dip zinc coating.

B. Self-Drilling Fasteners: No. 12-14 x 3/4 inch, hex washer head, self-drilling fastener with pilot point.

2.2 FABRICATION

A. Steel deck shall be formed with maximum distance of 2-5/8 inches between flutes at upper faces and a minimum distance of 2 inches at lower flute faces. Furnish units in lengths to be continuous over 3 spans wherever possible.

B. Unless otherwise indicated or approved, fabricate deck for predetermined openings, and reinforce where required to maintain deck strength, alignment, and profile.
   1. Small openings, as recommended by the deck manufacturer, may be field cut.

C. Accessories: Shop fabricated accessories, compatible with steel deck, as required to complete the Work, including, but not limited to, the following:
   1. Sheet metal cants beneath flashings when required for roofing over steel deck.
   2. Column closures, end closures, Z closures, and cover plates.

D. Progress shop fabrication from “APPROVED” or “APPROVED AS NOTED” detail drawings only.
   1. When detail drawings are “APPROVED AS NOTED”, progress fabrication in strict accordance with notes thereon.
   2. Fabrication progressed from “DISAPPROVED” or “RETURNED FOR CORRECTION” detail drawings will be rejected. The contractor shall have no claim against the State for any costs or delays due to rejection of items fabricated from “DISAPPROVED” or “RETURNED FOR CORRECTION” detail drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

B. Do not start installation of metal deck until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Coordinate installation sequence of metal deck with concrete encasement of steel beams.

C. Steel surfaces to which materials, provided under this Section, are to be welded, shall be free of paint, ice, water, oil, dirt, rust and other materials detrimental to welding.

D. Locate decking bundles to prevent overloading of supporting members.

3.2 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed instructions except where shown or specified otherwise.
   1. Welding shall comply with the AWS Code.
   2. Perform welding free of sharp points.

B. Place deck units on supporting steel framework and adjust to final position with ends bearing on supporting members and flutes in straight and true alignment through entire length of run before being permanently fastened. Do not stretch or contract side lap interlocks. Install temporary shoring before placing single span deck panels when required to meet manufacturer's recommendations.

C. End Bearing: Install deck units over supporting framing with a minimum end bearing of 1-1/2 inches, with end joints as follows:

   1. Non-Composite Deck End Joints: Lapped 2 inches minimum.

D. Deck Fastening: Fasten deck units at ends and intermediate supports with arc spot welds (puddle welds) not less than 5/8 inch diameter, at 12 inches on centers, along the supporting members, unless more stringent requirements are indicated on the drawings or required by the fire resistance ratings indicated on the drawings. Weld the first and last deck flutes. Use welding washers for all deck lighter than 20 gage. Deck units may be fastened to steel supports 0.18 inches or less in thickness (cold-formed metal framing) with No.12-14 x 3/4 inch self-drilling fasteners at 12 inches on center at ends and intermediate supports.

E. Side lap fastening: Fasten side laps at intervals not exceeding 36 inches, using one of the following methods, unless more stringent requirements are indicated on the drawings or required by the fire resistance ratings indicated on the drawings:

1. Mechanically fasten with self-drilling No.12 diameter or larger carbon steel screws.
2. Mechanically button punch.

F. Perimeter Edge Fastening: Weld starting and finishing side edges in bearing to supporting members at 36 inches on centers maximum, unless more stringent requirements are indicated on the drawings or required by the fire resistance ratings indicated on the drawings.

G. Neatly field cut required openings, other than shop fabricated openings, after installation in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Anchor Bolts: Installed under Section 033000 or 033001.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Structural Steel (including framing for floor grating): Section 05121.

1.03 REFERENCES

A. Except as shown or specified otherwise, the Work of this Section shall meet the requirements of the following:
   1. Design, Fabrication, and Erection: "Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design" adopted by the American Institute of Steel Construction, June 1, 1989 (AISC Specification).
      a. Design and Fabrication of Cold-Formed Shapes: "Specification for the Design of Cold-Formed Steel Structural Members", by the American Iron and Steel Institute (AISI Specification).
   2. Welding: "Structural Welding Code - Steel, AWS D1.1", or "Structural Welding Code - Sheet Steel, AWS D1.3", by the American Welding Society (AWS Codes).

B. Organizations:
   1. AISC: American Institute of Steel Construction, One East Wacker Dr., Suite 700, Chicago, IL 60601-1802, 866-275-2472, www.aisc.org.
   2. AISI: American Iron and Steel Institute, 1140 Connecticut Ave., NW, Suite 705, Washington, D.C. 20036, (202) 452-7100, www.steel.org.
   3. AWS: American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126, (800) 443-9353, www.aws.org.
   4. ANSI: American National Standards Institute, 1819 L Street, NW, 6th Floor, Washington, DC 20036, (202) 293-8020, www.ansi.org.
   5. ASME: ASME International, 3 Park Ave., New York, NY 10016-5990, (800) 843-2763, www.asme.org.
   6. ASTM: ASTM International, 100 Barr Harbor Dr., PO Box C700, West Conshohocken, PA, 19428-2959, (610) 832-9500, www.astm.org.
   7. MPI: The Master Painters Institute Inc., 2808 Ingleton Ave., Burnaby, BC, V5C 6G7, (888) 674-8937, www.specifypaint.com.
   8. SSPC: The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh PA 15222-4656, (877) 281-7772, www.sspc.org.

1.04 SUBMITTALS

A. Shop Drawings: Show application to project. Machine duplicated copies of Contract Drawings will not be accepted.
   1. Locate anchor bolts required for installation in other Work; furnish setting drawings and templates for required anchors.
   2. Indicate shop and field welds by standard AWS welding symbols in accordance with AWS A2.4.
   3. Floor Grating: Submit erection plan; include cutout areas and clearances.

B. Product Data: Catalog sheets, specifications, and installation instructions for each fabricated item specified, except submit data for fasteners only when indicated.

C. Quality Control Submittals:
   1. Certificates: Copy of certificates required under Quality Assurance Article.

1.05 QUALITY ASSURANCE

A. Galvanizing: Stamp galvanized items with galvanizer's name, weight of coating, and applicable ASTM number.

B. Certificates:
   1. Affidavit by the structural steel manufacturer certifying that structural steel items meet the contract requirements.
      a. Submit evidence of steel material compliance with this Specification. Evidence shall consist of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement.

1.06 DELIVERY AND STORAGE

A. Coordinate delivery of anchor bolts and other anchorage devices to be built into other construction to avoid delay.

B. Promptly cover and protect steel items delivered to the site.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wide Flange Structural Steel: ASTM A ~~36~~992, except as specified or shown otherwise.

B. M and S-Shapes, Channels and Angles: ASTM A 36 or ASTM A 572, Grade 50.

C. Steel Plates to be Bent or Cold-Formed: ASTM A 283, Grade C.

D. Merchant Quality Steel Bars: ASTM A 575, grade as selected by fabricator.

E. Anchors: Except where shown or specified, select anchors of type, size, style, grade, and class required for secure installation of metal fabrications. For exterior use and where built into exterior walls, anchors shall be galvanized or of corrosive-resistant materials.
   1. Threaded-Type Concrete Inserts: Galvanized ferrous casting, internally threaded to receive 3/4 inch diameter machine bolt; either malleable iron or cast steel.
   2. Wedge-Type Concrete Inserts: Galvanized box-type ferrous casting, designed to accept 3/4 inch diameter bolt having special wedge-shaped head; either malleable iron or cast steel.
      a. Bolts: Carbon steel bolts having special wedge-shaped heads, nuts, washers and shims.
   3. Slotted-Type Concrete Inserts: Galvanized 1/8 inch thick pressed steel plate complying with ASTM A 283; box-type welded construction with slot designed to receive 3/4 inch diameter square head bolt and with knockout cover.
   4. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent test agency.
      a. Carbon Steel: Zinc-Plated; ASTM B 633, Class Fe/Zn 5.
      b. Stainless Steel: Bolts, Alloy Group 1 or 2; ASTM F593, Nuts; ASTM F 594.

F. Shop Paint (General): Universal shop primer; fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

G. Bedding Mortar:
   1. Cement Grout: Portland cement complying with ASTM C 150, Type I or III, and clean uniformly graded natural sand complying with ASTM C 404, size No. 2; mixed at a ratio (by volume) of 1.0 part cement to 3.0 parts sand, with only the minimum amount of water required for placement and hydration.

2.02 FABRICATION

A. Use materials of the sizes and thicknesses indicated on the Drawings. If not indicated, use material of required size and thickness to produce adequate strength and durability for the intended use of the finished product.

B. Fabricate items to be exposed to view of material entirely free of surface blemish, including pitting, roller and seam marks, rolled trade names, and roughness.

Remove surface blemishes by grinding or by welding and grinding prior to cleaning, treating, and finishing.

C. Form metal true to line, with accurate angles, surfaces, and straight edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the metal.

D. Weld corners and seams continuously. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.

E. Form exposed connections with flush, smooth, hairline joints. Use concealed fasteners wherever possible. Use Phillips flathead (countersunk) screws or bolts for exposed fasteners, unless otherwise shown or specified.

F. Prepare fabricated items for anchorage of the type indicated, coordinated with the supporting structure. Fabricate and space anchoring devices as indicated or, if not indicated, as required to produce adequate support for the intended use of the item.

G. Punch, reinforce, drill, and tap fabricated items as required to receive hardware and other appurtenant items.

H. Shop Painting:
1. Cleaning Steel: Thoroughly clean all steel surfaces. Remove oil, grease, and similar contaminants in accordance with SSPC SP-1 “Solvent Cleaning”. Remove loose mill scale, loose rust, weld slag and spatter, and other detrimental material in accordance with SSPC SP-2 “Hand Tool Cleaning”, SSPC SP-3 “Power Tool Cleaning”, or SSPC SP-7 “Brush-Off Blast Cleaning”.
2. Apply one coat of shop paint to all steel surfaces except as follows:
   a. Do not shop paint steel surfaces to be field welded and steel to be encased in cast-in-place concrete.
   b. Apply 2 coats of shop paint, before assembly, to steel surfaces inaccessible after assembly or erection, except surfaces in contact.
   c. Do not paint galvanized items which are not to be finish painted under Section 099101.
3. Apply paint and compound on dry surfaces in accordance with the manufacturer’s printed instructions, and to the following minimum thickness per coat:
   a. Shop Paint (General): 4.0 mils wet film.

PART 3 EXECUTION

3.01 PREPARATION

A. Temporarily brace and secure items which are to be built into concrete, masonry, or similar construction.

B. Isolate non-ferrous metal surfaces to be permanently fastened in contact with ferrous metal surfaces, concrete, or masonry by coating non-ferrous metal surface with bituminous mastic, prior to installation.

3.02 INSTALLATION

A. Fit and set fabricated metal items accurately in designed locations, at proper elevation and alignment.

B. Use anchorage devices and fasteners of required type, size, and number as required to provide a secure, rigid installation.

C. Fit exposed connections accurately to form tight hairline joints. Weld connections which are not intended to be left as exposed joints, but cannot be shop welded because of size limitations. Grind welded joints smooth. Cut off exposed threaded portion of bolts flush with nut.

D. Attached Work: Drill holes for fasteners with power tools to exact size required. Unless otherwise shown on the Drawings, fasten metal Work to concrete and solid masonry anchorage with expansion anchors. Fasten metal Work to hollow masonry and stud partitions with square head toggle bolts.

E. Field Welding: Comply with AWS Codes for the procedures for shielded metal arc welding, for the appearance and quality of welds, and for the methods used in correcting welding Work.

END OF SECTION

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

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

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)
Sample

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: None See Section 16

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

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

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

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

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

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§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

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

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

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

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

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

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

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

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User Notes: (3B9ADA4E)

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

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§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

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

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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Payment Bond

CONTRACTOR:
(Name, legal status and address)

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

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)
Sample

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: None See Section 18

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

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

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

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

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

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User Notes: (3B9ADA45)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

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

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

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§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

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

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

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§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

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

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

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AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

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

Sample

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

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(Topics and numbers in bold are Section headings.)

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

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consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

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§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

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

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements,

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assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

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

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

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

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

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§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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

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

§ 3.4 Labor and Materials

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

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

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

§ 3.5 Warranty

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

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made 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 promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the

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Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

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

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

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§ 3.16 Access to Work
The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

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

§ 3.18 Indemnification
§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT
§ 4.1 General
§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

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

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

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the

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Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the 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, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. 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, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

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

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations

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and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

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

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

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

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

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor,

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prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

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

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

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

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work,

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promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

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.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

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

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

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

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

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

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

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

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will

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affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

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

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and

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unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

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

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

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

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§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

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

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

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

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

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

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

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

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

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

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

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

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

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

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

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§ 9.9 Partial Occupancy or Use

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

§ 9.9.2 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 Work.

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

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the 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 Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

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

.1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
.2 failure of the Work to comply with the requirements of the Contract Documents;
.3 terms of special warranties required by the Contract Documents; or
.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

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

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

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

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

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 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 and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is 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. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

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

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§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

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

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

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

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

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

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

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

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ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

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§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to

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the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

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§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 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 upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

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

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

§ 13.5 Interest

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

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ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

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the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

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

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

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

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

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

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

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract 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. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

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§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

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

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

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

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

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

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

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

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

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

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

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

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

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

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I, Michael Shilale, AIA, LEED, CPHC, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 15:06:24 on 12/22/2017 under Order No. 1200144258 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ - 2017, General Conditions of the Contract for Construction, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

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(Title)

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(Dated)

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SECTION 008100 - MODIFICATIONS TO GENERAL CONDITIONS

GENERAL

A. AIA Document A232, 2019 Edition, "General Conditions of the Contract for Construction, Construction Manager as Adviser Edition", shall be considered an incorporated portion of Contract, and its provisions, unless specifically indicated to be omitted, shall determine all questions which may arise concerning adjudication of disputes or other matters covered therein having relation to Contracts between Owner and Contractor.

B. Where any Article of AIA Document A232, 2019 Edition, is modified by alteration, addition or deletion, provisions of such Article shall remain in effect. All modifications shall be considered as added thereto. Where any such Article is amended, voided or superseded thereby, provisions of such Article not so specifically amended, voided or superseded shall remain in effect. Wherever a conflict exists between the Modifications to the General Conditions and any article of AIA Document 232, 2019 the provision of these Modifications shall prevail.

C. Where provisions of "General Conditions of the Contract for Construction, Construction Manager as Adviser Edition" relate to Project administrative or work-related requirements of the Contract, those provisions (including, but not limited to, allowances, progress schedule, submittal procedure, temporary facilities, cutting and patching, record drawings and clean-up) are specified in Division 1-General Requirements if required.

ARTICLE 1 - GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

(A) “Owner” (Article 2, General Conditions)

(B) "Architect" (Article 2, General Conditions) is Michael Shilale Architects, LLP, 140 Park Ave., New City, NY 10956.

(c) "General Contractor" (Article 3, General Conditions) is contractor having direct contract with Owner.

(d) "Contractor" (Article 3, General Conditions) is either General Contractor or Subcontractor having direct contract with General Contractor.

(e) "Other Contractor" is contractor having contract with Owner for work not herein specified.

(f) The Contractor shall allow the Owner or anyone employed by him, directly or indirectly, whether Union or non-Union, in the building and on the premises at all times.

(g) The term "Furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

(h) The term "Install" is used to describe operations at Project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".

A. Add the following sentence to Subparagraph 1.1.1:
   a. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulated electronic operations involving computers.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

A. Add clause 1.2.1.2 to Subparagraph 1.2.1:
1.2.1.2 In the event of conflicts or discrepancies among the contract documents, interpretations will be based on the following priorities:

1. Modifications
2. The Agreement
3. Addenda, with those of later date having precedence over those of an earlier date.
4. The supplementary conditions.
5. The General Conditions of contract for construction.
6. Division 1 of the specifications.
7. Drawings and divisions 2-33 of the specifications.
8. Other documents specifically enumerated in the agreements as part of the contract documents.

In the case of conflicts or discrepancies between drawings and divisions 2-33 of the specifications or within either document not clarified by addendum, the Architect will determine which takes precedence in accordance with Subparagraph 4.2.11, 4.2.12, and 4.2.13.

B. Add the following clause to section 1.7:
PDF files may be provided to contractor.

C. Delete section 1.8 and substitute to following:
Building Information Models will not be provided.

ARTICLE 2 - OWNER

2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

A. Delete Subparagraph 2.3.7 and substitute the following:
2.3.7 The Contractor will be furnished, free of charge two (2) copies of drawings and Project manuals. Additional sets will be furnished at the cost of reproduction, postage and handling.

ARTICLE 3 - CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

A. Add the following Subparagraph 3.2.4.1 to section 3.2.4:
3.2.4.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents to where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

3.4 LABOR AND MATERIALS

A. Add section 3.4.2.1 to section 3.4.2:
3.4.2.1 After the Contract has been executed, the Owner and Architect will consider requests for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications). By making requests for substitutions, the Contractor:

1. represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
2. represents that it will provide the same warranty for the substitution as it would have provided for the product specified.
3. certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that subsequently become apparent; and
4. shall coordinate the installation of the accepted substitute, making such changes as may be required for the

Work to be complete in all respects.

B. Add the following to the end of section 3.4.2:
3.4.2.2 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications resulting from such substitutions.

3.6 TAXES

A. Add section 3.6.1 to section 3.6:
The Owner is a School District, and is therefore exempt from sales tax. Sales tax is not to be included in the bids. This exemption does not, however, apply to tools, machinery, equipment, or other property leased by, or to the Contractor or a subcontractor; and the Contractor and its subcontractor shall be responsible for, and pay, any and all applicable taxes, including sales and compensating use taxes, on such leased tools, machinery, equipment or other property.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

A. Add subparagraph 3.11.1 as follows: "For additional requirements refer to Specification Section 017839 - PROJECT RECORD DOCUMENTS. Reference to 3.11 elsewhere in the Contract Documents shall read as referring to that section of the Specification."

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Add section 3.12.11 to section 3.12:
3.12.11 The Contractor is required to provide all submittals for the Architect's review, in accordance with the submittal deadlines noted in the Contract Documents. The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and one (1) resubmittal. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of additional resubmittals, and for evaluation of submittals received after the applicable deadline in the Contract Documents.

B. Add section 3.12.12 to section 3.12:
3.12.12 "For additional requirements refer to Specification Section 013300 – SUBMITTAL PROCEDURES. Reference to 3.12 elsewhere in the Contract Documents shall read as referring to that section of the Specification."

3.14 CUTTING AND PATCHING

A. Add subparagraph 3.14.3 as follows: "For additional requirements refer to Specification Section 024119 – SELECTIVE DEMOLITION. Reference to 3.14 elsewhere in the Contract Documents shall read as referring to that section of the Specification."

3.15 CLEANING UP

A. Add subparagraph 3.15.3 as follows: "For additional requirements refer to Specification Section 017419 - CONSTRUCTION WASTE MANAGEMENT and 017700 – CLOSEOUT PROCEDURES. Reference to 3.15 elsewhere in the Contract Documents shall read as referring to that section of the Specification."

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

A. Add the following subparagraph 4.2.2.1:
4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect and/or the Construction Manager for site visits made necessary by the fault or neglect of the Contractor or by defects and deficiencies in the Work.

B. Add the following subparagraph 4.2.14.1:
4.2.14.1 Contractor's requests for information shall be prepared and submitted in accordance with Division 1 "General Requirements" sections on the form included in the Contract Documents [OR] on AIA Document G716-2004. The Architect will return without action requests for information that do not conform to requirements for the Contract Documents.

ARTICLE 5 - SUBCONTRACTORS

5.2 AWARD OF SUBCONTRACTORS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

A. Add section 5.2.5 to section 5.2:

5.2.5 MANUFACTURERS AND FABRICATORS

5.2.5.1 Not later than thirty (30) days after the date of commencement of the Work, the Contractor shall furnish in writing to the Owner through the Architect the names of the persons or entities proposed as manufactures or fabricators for certain products, equipment and systems identified in the General Requirements (Division 1 of the Specifications) and, where applicable, the name of the installing Subcontractor. The Architect may reply within 14 days to the Contractor in writing stating 1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or 2) that the Architect requires additional time to review. Failure of the Owner or Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

5.2.5.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.2.5.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected manufacturer or fabricator was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute manufacturer's or fabricator's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

5.2.5.4 The Contractor shall not substitute a person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

ARTICLE 7 - CHANGES IN THE WORK

7.1 GENERAL

A. Add the following Subparagraph 7.1.4 to Paragraph 7.1:
7.1.4 The combined overhead and profit included in the total cost to the Owner of a change in the work shall be based on the following schedule:

1. For the Contractor, for Work performed by the Contractor's own forces, 15 percent of the cost.
2. For the Contractor, for Work performed by the Contractor's Subcontractor 7 percent of the amount due to the Subcontractor.
3. For each Subcontractor involved, for work performed by that subcontractor's own forces, 7 percent of the cost.

4. for each Subcontractor, for Work performed by the Subcontractor's sub-subcontractor, 7 percent of the amount due the sub-subcontractor.
5. Cost to which overhead and profit is to be applied shall be determined in accordance with subparagraph 7.3.7.
6. In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and Materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over $500.00 be approved without such itemization.

.2 CHANGE ORDERS

A. Delete Subparagraph 7.2.1 and substitute as follows:

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

.1 The change in the Work;

.2 The amount of the adjustment, if any, in the Contract Sum; and

.3 The extent of the adjustment, if any, in the Contract Time.

ARTICLE 8 - TIME

8.3 DELAYS AND EXTENSIONS OF TIME

Delete paragraph 8.3.1 and substitute as follows:

"8.3.1 If the Contractor is delayed at any time in the progress of the work by such causes which the Architect determines justifies the delay, the Contract time shall be extended by Change Order for such reasonable time as the Architect may determine. The Contractor agrees to make no claim against the Owner, Construction Manager or the Architect, Architect's Consultants or Architect's Subcontractors, for damages for delay in the performance of this contract occasioned by any act or omission of the Owner or any of its representatives, or the Construction Manager, Architect, Architect's Consultants or Architect's Subcontractors, and agrees that any such claim shall be fully compensated for by an extension of time to complete performance of the work as provided herein. The delays contemplated by this paragraph include, but are not limited to, loss or damage arising out of, or related to, any unforeseen obstructions or difficulties which may be encountered during the performance of the contract, including damages which may be caused or occasioned by the contractor's reliance upon such records, reports or information furnished by the Owner, Construction Manager or Architect or Architect's Consultants or Architect's Subcontractors. An extension of time to complete performance is an equitable adjustment as contemplated by paragraph 14.3.2 of the General Conditions of the contract. When the act or omission of another contractor causes delays resulting in damage to the Contractor, the Contractor damaged thereby must proceed against the offending contractor and shall make no claim against the Owner, Construction Manager or Architect or Architect's Consultants or Architect's Subcontractors."

IT IS EMPHASIZED THAT NO MONETARY RECOVERY MAY BE OBTAINED BY THE CONTRACTOR FOR DELAY AGAINST THE OWNER, CONSTRUCTION MANAGER, OR ARCHITECT BASED ON ANY REASON AND THAT THE CONTRACTOR'S SOLE REMEDY, IF APPROPRIATE, IS ADDITIONAL TIME."

8.3.2 Delete in its entirety.

8.3.3 Delete the words "either party" in line 2 and replace with the words "the Owner."

ARTICLE 9 - PAYMENT AND COMPLETION

9.3 APPLICATION FOR PAYMENTS

A. 9.3.1 Add the following sentence to the end of Subparagraph 9.3.1:
The form of Application for Payment, duly notarized, shall be current authorized edition of AIA Document G702-1992, Application and Certificate for Payment, supported by a current authorized edition of AIA Document G703-1992, Continuation Sheet.

B. Add the following clause 9.3.1.3 to Subparagraph 9.3.1:
9.3.1.3 Until the work is ninety (90%) percent complete, the Owner shall pay ninety (90%) percent of the amount due the Contractor on the account of progress payments. At the time of Work is 90 percent complete and thereafter, the Owner shall pay ninety-five (95%) percent of the amount due to the Contractor until punch list completion, subject however to the provisions of Article 5 of AIA Document A132-2019.

9.6 To subparagraph 9.6.1 add the following:

A. "Certificates for Payment shall be issued monthly if work is progressing satisfactorily and if application for payment has been submitted

9.8 SUBSTANTIAL COMPLETION

A. Add section 9.8.3.1 after 9.8.3
9.8.3.1 The Architect will perform no more than one (1) inspection to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

B. Add to section 9.8.5: In no event shall the outstanding amount be less than two hundred (200%) percent of the value of the incomplete Work and unsettled claims.

9.10 FINAL COMPLETION AND FINAL PAYMENT

A. Add the following section 9.10.1.1 to section 9.10.1:
9.10.1.1 The Architect will perform no more than one (1) inspection to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

B. To subparagraph 9.10.2 add the following: "Upon demand by the Owner, Contractor shall provide and file bond for discharge of any lien, as required by Lien Law, State of New York, Section 21, Paragraph 5."

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

A. No Modifications

ARTICLE 12 – UNCOVERING AND CORRECTION OF WORK

A. No Modifications

ARTICLE 15 – CLAIMS AND DISPUTES

A. Add the following Sections 15.1.6.3 and 15.1.6.4 to Section 15.1.6:

15.1.6.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis

for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indication all the activities affected by the circumstances forming the basis of the Claim.

15.1.6.4. The Contractor shall not be entitled to a separate increase in the Contact Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

END OF SECTION 008100

SECTION 008150 - UNIFORM SAFETY STANDARDS FOR SCHOOL CONSTRUCTION AND MAINTENANCE PROJECTS

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

1.02 Indication that all school areas to be disturbed during renovation or demolition have been or will be tested for lead and asbestos. Note, the project folder should contain a letter regarding the presence of asbestos.

1.03: **"**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) Workers shall be required to wear photo-identification badges at all times for identification and security purposes while working at occupied sites."

1.04 "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.

(1) 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.

(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."

1.05 A plan detailing how exiting required by the applicable building code will be maintained work for this project will be completed while school not in session.

1.06 A plan detailing how adequate ventilation will be maintained during construction work for this project will be completed while school is not in session.

1.07:"Construction and maintenance operations shall not produce noise in excess of 60 d.b.a. 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."

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

1.09:"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."

1.10:"Large and small asbestos abatement projects as defined by 12NYCRR56 shall not be performed while the building is occupied". Note, It is our interpretation that the term "building", as referenced in this section, means a wing or major section of a building that can be completely isolated from the rest of the building with sealed noncombustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion and ventilation systems must be physically separated and sealed at the isolation barrier.

Exterior work such as roofing, flashing, siding, or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems and at windows is provided. Care must be taken to schedule work so that classes are not disrupted by noise or visual distraction.

1.11 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.

WAGE RATE REQUIREMENTS

1. As required by Wickes Law, all contractors and sub-contractors on construction work must pay wages that are equal to, or greater than, the prevailing wage rates determined by the federal government. A copy of the said rates is attached to the specifications herein. Contractors and sub-contractors will be required to submit weekly payroll records certifying actual wages paid.

   A. 008310 Prevailing Wage Rates for Stony Point ES, Thiells ES, and West Haverstraw ES HVAC Replacement

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Multiple Work Packages.
4. Work under Owner's separate contracts.
5. Contractor's use of site and premises.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.
9. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 017300 "Execution" for coordination of Owner-installed products.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

A. Project Identification: 43040 Stony Point Elementary School

1. Project Location: 7 Gurnee Drive, Stony Point, NY, 10980.

B. Project Identification: 43041 Theills Elementary School

1. Project Location: 78 Rosman Road, Theills, NY, 10984

C. Project Identification: 43042 West Haverstraw Elementary School

1. Project Location: 71 Blauvelt Ave, West Haverstraw, NY, 10993

D. Owner: NRCSD, 65 Chapel Street, Garnerville, New York, 10923, United States.

1. Owner's Representative: Michael Senno, Central Office Administrator

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E. Architect: Michael Shilale Architects, LLP, 140 Park Avenue, New City, New York, 10956.

1. Architect's Representative: MSA Architects, LLP.

F. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. MEP & Structural : GPI Engineering .

G. Contractor: to be selected has been engaged as Contractor for this Project.

H. Construction Manager: Palombo Group .

1. Construction Manager Representative: Lou Rodriguez .
2. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for construction between Owner and each Contractor, according to a separate contract between Owner and Construction Manager.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Stony Point Elementary School, Theills Elementary School and West Haverstraw Elementary School Univent replacement and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under coordinated, concurrent multiple contracts. See Section 011200 "Multiple Contract Summary" for a list of multiple contracts, a description of work included under each of the multiple contracts, and the responsibilities of Project coordinator.

1.6 WORK UNDER OWNER'S SEPARATE CONTRACTS

A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.

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

1. To be determined by Owner

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

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

B. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits on Use of Site: Confine construction operations to work area defined on drawings.
2. Driveways, Walkways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

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a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.9 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7 a.m. to 4 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: with approval by the owner .
2. Early Morning Hours: with approval by the owner .
3. Work in Existing Building: not permitted while school is in session .
4. Hours for Utility Shutdowns: to be coordinated with the owner 48 hours in advance .
5. Hours for Core Drilling or loud activities : to be coordinated with owner 48 hours in advance .

C. 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 for temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Construction Manager's written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Construction Manager not less than two days in advance of proposed disruptive operations.
2. Obtain Construction Manager's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products , alcoholic beverages, and other controlled substances on Owner's property is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

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G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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SECTION 011200 - MULTIPLE CONTRACT SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.

B. Specific requirements for Work of each contract are also indicated in individual Specification Sections and on Drawings.

C. Related Requirements:

1. Section 011000 "Summary" for the Work covered by the Contract Documents, restrictions on use of Project site, phased construction, coordination with occupants, and work restrictions.
2. Section 013100 "Project Management and Coordination" for general coordination requirements.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

1.4 PROJECT COORDINATOR

A. Project coordinator shall be responsible for coordination between the General Construction Contract,, HVAC Contract, Electrical Contract.

1. HVAC Contractor will act as Project Coordinator.

1.5 COORDINATION ACTIVITIES

A. Coordination activities of Project coordinator include, but are not limited to, the following:

1. Provide overall coordination of the Work.
2. Coordinate shared access to workspaces.
3. Coordinate product selections for compatibility.
4. Provide overall coordination of temporary facilities and controls.
5. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.
6. Coordinate construction and operations of the Work with work performed by each Contract and Owner's construction forces and separate contracts.
7. Prepare coordination drawings in collaboration with each contractor to coordinate work by more than one contract.
8. Coordinate sequencing and scheduling of the Work. Include the following:

a. Initial Coordination Meeting: At earliest possible date, arrange and conduct a meeting with contractors for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.
b. Prepare a combined contractors' construction schedule for entire Project. Base schedule on preliminary construction schedule. Secure time commitments for performing critical construction activities from contractors. Show activities of each contract on a separate sheet. Prepare a simplified summary sheet indicating combined construction activities of contracts.

1) Submit schedules for approval.
2) Distribute copies of approved schedules to contractors.

9. Provide photographic documentation.
10. Provide quality-assurance and quality-control services specified in Section 014000 "Quality Requirements."
11. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.
12. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.
13. Locate existing permanent benchmarks, control points, and similar reference points, and establish permanent benchmarks on Project site.
14. Provide field surveys of in-progress construction and site work and final property survey.
15. Provide progress cleaning of common areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked.
16. Coordinate cutting and patching.
17. Coordinate protection of the Work.
18. Coordinate firestopping.
19. Coordinate completion of interrelated punch list items.
20. Coordinate preparation of Project record documents if information from more than one contractor is to be integrated with information from other contractors to form one combined record.
21. Print and submit record documents if installations by more than one contractor are indicated on the same contract drawing or shop drawing.
22. Collect record Specification Sections from contractors, collate Sections into numeric order, and submit complete set.
23. Coordinate preparation of operation and maintenance manuals if information from more than one contractor is to be integrated with information from other contractors to form one combined record.

B. Responsibilities of Project coordinator for temporary facilities and controls include, but are not limited to, the following:

1. Provide common-use field office for use by all personnel engaged in construction activities.

1.6 GENERAL REQUIREMENTS OF CONTRACTS

A. Extent of Contract: Unless the Agreement contains a more specific description of the Work of each Contract, requirements indicated on Drawings and in Specification Sections determine which contract includes a specific element of Project.

1. Unless otherwise indicated, the work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.
2. Trenches and other excavation for the work of each contract shall be the work of each contract for its own work.
3. Blocking, backing panels, sleeves, and metal fabrication supports for the work of each contract shall be the work of each contract for its own work.
4. Furnishing of access panels for the work of each contract shall be the work of each contract for its own work. Installation of access panels shall be the work of the General Construction Contract.
5. Equipment pads for the work of each contract shall be the work of each contract for its own work.
6. Roof-mounted equipment curbs for the work of each contract shall be the work of each contract for its own work.
7. Painting for the work of each contract shall be the work of each contract for its own work.
8. Cutting and Patching: Each contract shall perform its own cutting; patching shall be under the General Construction Contract.

9. Through-penetration firestopping for the work of each contract shall be provided by each contract for its own work.
10. Contractors' Startup Construction Schedule: Within five working days after startup horizontal bar-chart-type construction schedule submittal has been received from Project coordinator, submit a matching startup horizontal bar-chart schedule showing construction operations sequenced and coordinated with overall construction.

B. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the work.

1. Project coordinator shall coordinate substitutions.

C. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Section 015000 "Temporary Facilities and Controls," each contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
3. Its own field office, complete with necessary furniture, utilities, and telephone service.
4. Its own storage and fabrication sheds.
5. Temporary enclosures for its own construction activities.
6. Staging and scaffolding for its own construction activities.
7. General hoisting facilities for its own construction activities, up to 2 tons (2000 kg).
8. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary, or other harmful waste materials.
9. Progress cleaning of work areas affected by its operations on a daily basis.
10. Secure lockup of its own tools, materials, and equipment.
11. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.

D. Temporary Heating, Cooling, and Ventilation: Project coordinator] is responsible for temporary heating, cooling, and ventilation, including utility-use charges, temporary meters, and temporary connections.

E. Use Charges: Comply with the following:
1. Water Service: Include the cost for water service, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site in the General Construction Contract.
2. Electric Power Service: Include the cost for electric power service, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site in the General Construction Contract.

1.7 GENERAL CONSTRUCTION CONTRACT

A. Supply all necessary materials, labor, services, equipment, and tools required to perform the following site General Construction, work for the UV Replacement and Rooftop HVAC Units. All work to be installed in strict accordance with Specifications and Drawings.

B. Supply all necessary materials, equipment, devices and labor for implementation and up-keep of site safety as it relates to this scope of work, to meet or exceed OSHA and / or safety agencies having jurisdiction on this project. Any and all costs resulting from OSHA sited violations will be the complete responsibility of this subcontractor.

C. This project is a prevailing wage project, and it is the responsibility of this sub-contractor to ensure that all of the latest rules and regulations published by the NYS Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit are strictly followed and adhered to. In the events of an audit conduct by the NYS Department of Labor, this sub-contractor will be responsible for any and all costs associated with the audit and the Departments' final decision.

D. Work in the General Construction Contract includes, but is not limited to, the following:
1. Ceiling tile removal and installation. Provide replacement tiles and grid if damaged during removal.
2. New ACT ceilings: suspended ceiling and tiles.
3. Gypsum ceiling removal as required for HVAC ductwork. New gypsum ceiling to replace removed sections.
4. Supply all materials, labor, equipment, and tools for installation of metal stud partition to encase new ductwork, relief air gypsum enclosures, and HVAC lines.
5. Supply all materials, labor, equipment, and tools to install and finish gypsum at newly constructed metal stud chases, wall area, and masonry walls. Finish and paint all new surfaces, and any damaged existing surfaces.
6. Supply all materials, labor, equipment, and tools to install all access panels, patch and paint all disturbed areas.
7. Supply and install all necessary blocking, anchors, and hangers to support and secure ductwork, and roof curbs.
8. Supply all materials, labor, equipment, and tools to modify/construct all interior walls, gypsum and masonry patching and paint as required.
9. File, pay for, and obtain all required permit, inspections and approvals.
10. Schedule and perform all inspections required by this scope of work.
11. Removal and disposal of daily generated debris. Upon completion of this contractor's work, all excess materials and debris in the building and site are to be removed and disposed of promptly.
12. Cut and patch roofing. The roof has a Tremco built-up roof. Contractor shall comply with Tremco standards to extend warranty to new areas.
13. Fabricate, install, and paint all line set enclosures.
14. This is a prevailing wage project.
15. Structural work for installation of roof top units.
16. Cut and install FAI in existing insulating panel, louver to be provided by HVAC contractor.
17. Casework modification as require to accept new unit ventilators

1.8 PLUMBING CONTRACT – VOID, NOT IN CONTRACT

1.9 HVAC CONTRACT

A. Supply all necessary materials, labor, services, equipment and tools required to perform the following site electrical work for the UV Replacement and Rooftop HVAC Units. All work to be installed in strict accordance with Specifications and Drawings.

B. Supply all necessary materials, equipment, devices and labor for implementation and up-keep of site safety as it relates to this scope of work, to meet or exceed OSHA and / or safety agencies having jurisdiction on this project. Any and all costs resulting from OSHA sited violations will be the complete responsibility of this subcontractor

C. This project is a prevailing wage project and it is the responsibility of this sub-contractor to ensure that all of the latest rules and regulations published by the NYS Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit are strictly followed and adhered to. In the events of an audit conduct by the NYS Department of Labor, this sub-contractor will be responsible for any and all costs associated with the audit and the Departments' final decision.

D. Work in the HVAC Contract includes, but is not limited to, the following:
1. Remaining work not identified as work under other contracts.
2. Curbs, RTUs/UV's/ VRF's, and accessories to be hoisted onto the roof or required floor level.
3. Assemble roof curbs and dunnage, set in place, anchor, and flash to roof structure.
4. Supply and install galvanized supply and return curb transitions.
5. Install RTUs onto curbs and weather-tight.
6. Install all RTU accessories, including filters.
7. Install UV's and new cabinets, associated ductwork work and duct/pipe insulation.

8. Install thermostats connect to BMS and make connections at RTUs, UV's, and VRF's
9. Program thermostats for heat, cooling, and occupied & unoccupied times.
10. Make all supply and return ductwork connections.
11. Start up and test RTUs/UV's/VRF's/FAI for heat. Cooling and fresh air where applicable.
12. Adjust all volume dampers and diffusers to provide proper air flow.
13. Make all ductwork connections for fans.
14. Test all fans.
15. Balance system as per specifications.
16. File, pay for, and obtain all required permit, inspections, and approvals.
17. Schedule and perform all inspections required by this scope of work.
18. Removal and disposal of daily generated debris.
19. Demolition of existing system that are being replaced.
20. Upon completion of this contractor's work, all excess materials and debris in the building and site are to be removed and disposed of promptly.
21. Integrate with current BMS system.
22. This is a prevailing wage project.
23. Installation of duct smoke detectors, provided by the Electrical Contractor.
24. Provide general contractor FAI louver for insulated panel.

E. Temporary facilities and controls in the HVAC Contract include, but are not limited to, the following:

1. Temporary facilities and controls that are not otherwise specifically assigned to the Plumbing Contract.
2. Temporary enclosure for building exterior.
3. Temporary roads and paved areas.
4. Project identification and temporary signs.
5. General waste disposal facilities.
6. Temporary fire-protection facilities.
7. Barricades, warning signs, and lights.
8. Site enclosure fence.
9. Security enclosure and lockup.
10. Environmental protection.
11. Restoration of Owner's existing facilities used as temporary facilities.

1.10 ELECTRICAL CONTRACT

A. Supply all necessary materials, labor, services, equipment and tools required to perform the following site electrical work for the UV Replacement and Rooftop HVAC Units. All work to be installed in strict accordance with Specifications and Drawings.

B. Supply all necessary materials, equipment, devices and labor for implementation and up-keep of site safety as it relates to this scope of work, to meet or exceed OSHA and / or safety agencies having jurisdiction on this project. Any and all costs resulting from OSHA sited violations will be the complete responsibility of this subcontractor

C. This project is a prevailing wage project and it is the responsibility of this sub-contractor to ensure that all of the latest rules and regulations published by the NYS Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit are strictly followed and adhered to. In the events of an audit conduct by the NYS Department of Labor, this sub-contractor will be responsible for any and all costs associated with the audit and the Departments' final decision.

D. Work in the Electrical Contract includes, but is not limited to, the following:
1. Supply and install all electrical materials, devices, and equipment for the RTU, UV, and VRF heat pumps .
2. Supply and install complete electrical service from source to new RTU's and VRF, heat pumps.
3. Supply and install complete electrical service from source to new RTU and VRF Condenser units.
4. Supply and install RTU and VRF disconnects and make electrical connections.
5. Supply and install RTU and VRF maintenance receptacles and make electrical connections.
6. Disconnect and reconnect electrical connection to UV's .

7. Test all site installed systems.
8. Test all factory installed systems.
9. File and obtain and pay for all required permits, inspections, and approval.
10. Provide duct detectors to Mechanical Contractor.
11. Schedule and perform all inspections required by this scope of work.
12. Start up RTUs
13. Supply, install and coordinate fire alarm wiring and devices. Provide duct detectors to HVAC Contractor for installation.
14. Removal and disposal of daily generated debris.
15. Upon completion of this contractor's work, all excess materials and debris in the building, connecting link and site are to be removed and disposed of promptly, and site restored to original condition.
16. Uninstall existing light fixtures and reinstall existing light fixtures in ceilings as noted for HVAC work. Provide and install new light fixtures as designated in replaced ceilings for both base bid and alternates.
17. This is a prevailing wage project.

E. Temporary facilities and controls in the Electrical Contract include, but are not limited to, the following:

1. Electric power service and distribution.
2. Electrical connections to existing systems and temporary facilities and controls furnished by the General Construction Contract, Plumbing Contract, HVAC Contract, Electrical Contract,.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011200

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.
4. Testing and inspecting allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.4 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.5 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

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1.6 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight [**,**] and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight [**,**] and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.9 QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight [**,**] and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

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1.10 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of testing and inspection services not specifically required by the Contract Documents are Contractor responsibilities and are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.11 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs due to a change in the scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

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.

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3.3 SCHEDULE OF ALLOWANCES

STONY POINT ELEMENTARY SCHOOL

A. Allowance No. 100: Replace existing supply and return piping and insulation for 40 linear feet per each unit ventilator.

B. Allowance No. 101: Contractor to include an allowance for the LF of line set enclosure noted on the drawings.

C. Allowance No. 102: Provide allowance for the relocation of 40 electrical devices (per building) that require relocation due to new UV size.

D. Allowance No. 103: Electrical contractor to provide new power connections to 10 existing UV locations (per building) where existing cannot be reused.

E. Allowance No. 104: Provide allowance to clean existing main ductwork for 20 linear feet per unit.

F. Allowance No. 105: Provide a proposal from a third-party HVAC commissioning agent. Contractor to include this amount in their base bid. Contractor will issue a credit change order to the owner for the commissioning proposal amount. Owner will contract directly with the commissioning agent.

G. Allowance No. 106: GC to include **$80,000** allowance for front entry door and storefront replacement.

THEILLS ELEMENTARY SCHOOL

H. Allowance No. 200: Replace existing supply and return piping and insulation for 40 linear feet per each unit ventilator.

I. Allowance No. 201: Contractor to include an allowance for the LF of line set enclosure noted on the drawings.

J. Allowance No. 202: Provide allowance for the relocation of 40 electrical devices (per building) that require relocation due to new UV size.

K. Allowance No. 203: Electrical contractor to provide new power connections to 10 existing UV locations (per building) where existing cannot be reused.

L. Allowance No. 204: Provide allowance to clean existing main ductwork for 20 linear feet per unit.

M. Allowance No. 205: Provide a proposal from a third-party HVAC commissioning agent. Contractor to include this amount in their base bid. Contractor will issue a credit change order to the owner for the commissioning proposal amount. Owner will contract directly with the commissioning agent.

WEST HAVERSTRAW ELEMENTARY SCHOOL

N. Allowance No. 300: Replace existing supply and return piping and insulation for 40 linear feet per each unit ventilator.

O. Allowance No. 301: Contractor to include an allowance for the LF of line set enclosure noted on the drawings.

P. Allowance No. 302: Provide allowance for the relocation of 40 electrical devices (per building) that require relocation due to new UV size.

Q. Allowance No. 303: Electrical contractor to provide new power connections to 10 existing UV locations (per building) where existing cannot be reused.

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R. Allowance No. 304: Provide allowance to clean existing main ductwork for 20 linear feet per unit.

S. Allowance No. 305: Provide a proposal from a third-party HVAC commissioning agent. Contractor to include this amount in their base bid. Contractor will issue a credit change order to the owner for the commissioning proposal amount. Owner will contract directly with the commissioning agent.

END OF SECTION 012100

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SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the Part 3 "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 100: Provie a unit price to replace additional existing supply and return piping and insulation. Price is per 10 linear feet. (This amount will add or reduce allowance no. 100, 200, 300).

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B. Unit Price No. 101: Provide a unit price for the installation of 10 LF of line set enclosure. (This amount will add or reduce allowance no. 101, 201, 301).

C. Unit Price No. 102: Electrical contractor to provide a unit price to relocate an existing electrical device that is required to be relocated. Price per 1 device. (This amount will add or reduce allowance no. 102, 202, 302).

D. Unit Price No. 103: Electrical contractor to provide new power connection to existing UV location where existing feeder cannot be reused. Price per 1 feed. (This amount will add or reduce allowance no. 103, 203, 303).

E. Unit Price No. 104: GC to provide a price to add or remove 100 SF of new 2X2 ACT ceiling. (This amount will add or reduce alternate nos. 100, 200, 300).

END OF SECTION 012200

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SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the 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. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 100: For Stony Point Elementary School include ceiling and lighting replacement in areas where existing is called to be removed and reinstalled. See architectural demolition and reflected ceiling plans.

B. Alternate No. 200: For Theills Elementary School include ceiling and lighting replacement in areas where existing is called to be removed and reinstalled. See architectural demolition and reflected ceiling plans.

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C. Alternate No. 300: For West Haverstraw Elementary School include ceiling and lighting replacement in areas where existing is called to be removed and reinstalled. See architectural demolition and reflected ceiling plans.

END OF SECTION 012300

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SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 012100 "Allowances" for products selected under an allowance.
2. Section 012300 "Alternates" for products selected under an alternate.
3. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying 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 Project Manual .
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
   b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. Certificates and qualification data, where applicable or requested.
   g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.

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h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES .
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: 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.

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1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
   a. Requested substitution 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.
   b. Requested substitution does not require extensive revisions to the Contract Documents.
   c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   d. Substitution request is fully documented and properly submitted.
   e. Requested substitution will not adversely affect Contractor's construction schedule.
   f. Requested substitution has received necessary approvals of authorities having jurisdiction.
   g. Requested substitution is compatible with other portions of the Work.
   h. Requested substitution has been coordinated with other portions of the Work.
   i. Requested substitution provides specified warranty.
   j. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

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Request for Substitution

This form must be completely filled in with all relevant data by the Subcontractor and submitted to the Project Manager for consideration before any request to change the drawing or specification requirements will be considered.

REFERENCE DATA

Project name: _____ Date of Request: _____

Location: _____ Architect's Job No: _____

Request by (firm): _____

Address: _____

Contact person: _____ Phone: _____ FAX: _____

Subcontract works: _____ Package No: _____

SUBSTITUTION REQUEST DATA

SUBSTITUTION REQUESTED IS FOR:

- ☐ Named product.
- ☐ Product type, material, finish or formulation.
- ☐ Fabrication or installation methods.

Reason for request: _____

PRODUCT / MATERIAL / METHOD FOR WHICH SUBSTITUTION IS REQUESTED IS SHOWN ON THE FOLLOWING DOCUMENTS:

Specification: Section No: _____ Page(s): _____ Clause No(s): _____

Drawings: (List No's of all Drawings affected): _____

COST/BENEFIT ANALYSIS

Describe in detail any alteration to any other part of the Works required by use of the requested substitution:

Total nett cost of any such other required alterations, including overhead and profit: $ _____

Cost of Builder's administration (to be filled in by Builder): $ _____

Cost of Architect's documentation and administration (to be filled in by Project Manager): $ _____

Total cost of such other alterations (to be filled in by Project Manager): $ _____

Total cost savings achieved (from page 2, to be filled in by Project Manager): $ _____

Total cost/benefit to Proprietor (to be filled in by Project Manager): $ _____

Benefits to Proprietor other than financial: _____

ADDITIONAL INFORMATION REQUIRED

COMPLETE THE REVERSE SIDE AS APPLICABLE.

ATTACH THE FOLLOWING INFORMATION:

1 Manufacturer's technical data sheets on proposed products.
2 Manufacturer's standard form of warranty.
3 Letter on manufacturer's letterhead stating that manufacturer will warrant products as specified, if specification

COMPARISON OF OPTIONS

Fill in the following blanks as are applicable to the product, material or method type. As a guide, if the item is mentioned in the Specification as a performance or materials requirement, then information about the proposed substitution is required by the Project Manager to evaluate the proposed substitution. Requests lacking relevant information will be returned without action.

SPECIFIED PRODUCT, MATERIAL OR METHOD	PROPOSED SUBSTITUTION
Description:	Description:
Product Name:	Product Name:
Type:	Type:
Model No:	Model No:
Fire rating (hours):	Fire rating (hours):
Thickness:	Thickness:
Composition:	Composition:
Availability (time):	Availability (time):
Country of manufacture:	Country of manufacture:
Substrate preparation required:	Substrate preparation required:
Length of warranty available (years):	Length of warranty available (years):
Sound transfer coefficient (STC):	Sound transfer coefficient (STC):
Exposure class:	Exposure class:
Resistance to chemicals (list):	Resistance to chemicals (list):
Other specified performance criteria (list):	Other specified performance criteria (list):
UNIT COST OF PRODUCT / MATERIAL (Must be completed):	UNIT COST OF PRODUCT / MATERIAL (Must be completed):
$ _____ What _____	$ _____ What _____
Units required: _____ Total value: $ _____	Units required: _____ Total value: $ _____

BUILDER'S REVIEW

I certify that I have checked the above documentation for the proposed Request for Substitution and warrant it to be substantially complete and accurate:

Signed by: _____

Date: _____

PROJECT MANAGER'S ACTION

☐ Request approved.

☐ Request approved subject to qualifications per attached documentation.

☐ Request denied.

☐ Refer Variation Order No: _____

Approved by: _____

Date: _____

Comments: _____

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 .

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
2. Within 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use forms acceptable to Architect .

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

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4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect .

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Construction Manager will issue a Change Order for signatures of Owner and Contractor on AIA Document G701CMa .

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Construction Manager may issue a Construction Change Directive on AIA Document G714CMa . Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
4. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect through Construction Manager at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract, as described in Section 011000 "Summary."

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and Construction Manager and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G703 and AIA Document G732 as form for Applications for Payment.

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D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment .

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Sustainable design action plans, including preliminary project materials cost data.
7. Schedule of unit prices.
8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.
12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
13. Initial progress report.
14. Report of preconstruction conference.

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I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

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SECTION 013100 - 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. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
2. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
5. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

A. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

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1.5 GENERAL COORDINATION PROCEDURES

A. Coordination of Multiple Contracts: Each contractor shall cooperate with Project coordinator, who shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

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 scheduled activities of other contractors and direction of Project coordinator 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.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
   c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
   e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   f. Indicate required installation sequences.
   g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format:
   a. DWG , Version , operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using PDF format.
3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
   a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
   b. Digital Data Software Program: Drawings are available in Autocad 2020. .
   c. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Agreement form acceptable to Owner and Architect.

1.7 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

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B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Owner name.
3. Owner's Project number.
4. Name of Architect and Construction Manager.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Form bound in Project Manual .

1. Attachments shall be electronic files in PDF format.

D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect or Construction Manager of additional information.
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 Section 012600 "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly .

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Construction Manager.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's and Construction Manager's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

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F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in Autocad 2020 .
4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement .
    a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106 .
5. The following digital data files will be furnished for each appropriate discipline:
    a. Floor plans.
    b. Reflected ceiling plans.

B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

A. General: Construction Manager will 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 a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Construction Manager will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner , Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. 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. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use of web-based Project software.

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h. Procedures for processing field decisions and Change Orders.
i. Procedures for RFIs.
j. Procedures for testing and inspecting.
k. Procedures for processing Applications for Payment.
l. Distribution of the Contract Documents.
m. Submittal procedures.
n. Preparation of Record Documents.
o. Use of the premises and existing building.
p. Work restrictions.
q. Working hours.
r. Owner's occupancy requirements.
s. Responsibility for temporary facilities and controls.
t. Procedures for moisture and mold control.
u. Procedures for disruptions and shutdowns.
v. Construction waste management and recycling.
w. Parking availability.
x. Office, work, and storage areas.
y. Equipment deliveries and priorities.
z. First aid.
aa. Security.
bb. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect , Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility requirements.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written instructions.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.
   v. Coordination with other work.
   w. Required performance results.
   x. Protection of adjacent work.
   y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

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5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of Record Documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Procedures for completing and archiving web-based Project software site data files.
   d. Submittal of written warranties.
   e. Requirements for completing sustainable design documentation.
   f. Requirements for preparing operations and maintenance data.
   g. Requirements for delivery of material samples, attic stock, and spare parts.
   h. Requirements for demonstration and training.
   i. Preparation of Contractor's punch list.
   j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   k. Submittal procedures.
   l. Coordination of separate contracts.
   m. Owner's partial occupancy requirements.
   n. Installation of Owner's furniture, fixtures, and equipment.
   o. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Construction Manager will conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner , Construction Manager, 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. 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) Status of sustainable design documentation.
      5) Deliveries.
      6) Off-site fabrication.
      7) Access.
      8) Site use.
      9) Temporary facilities and controls.
      10) Progress cleaning.
      11) Quality and work standards.
      12) Status of correction of deficient items.
      13) Field observations.

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14) Status of RFIs.
15) Status of Proposal Requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
   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.

F. Coordination Meetings: Project Coordinator will conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined 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.
   b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
   c. Review present and future needs of each contractor 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 use.
      8) Temporary facilities and controls.
      9) Work hours.
      10) Hazards and risks.
      11) Progress cleaning.
      12) Quality and work standards.
      13) Status of RFIs.
      14) Proposal Requests.
      15) Change Orders.
      16) Pending changes.
2. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

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Michael Shilale, AIA, LEED
John Cirilli, AIA

REQUEST FOR INFORMATION

MICHAEL SHILALE ARCHITECTS, LLP

140 Park Avenue ☐ New City, New York 10956 ☐ Tel 845-708-9200 ☐ Fax 845-708-9222 ☐ E-mail info@shilale.com

Send all RFI's in writing to Michael Shilale Architects, LLP at the above address/fax number. **Only this form will be accepted, and no questions will be entertained via telephone. By submitting this Request for Information, the Contractor is stating that they have performed a thorough review of the drawings and specifications and the information requested is not contained in the construction documents.**

Project:	© Michael Shilale Architects, LLP	**RFI No.** Univent
MSA File No.:		03-04-25
NYSED No.:		
Contractor:		
Contract for:	Hazardous Materials Abatement ☐ Demolition ☐ Site Construction ☐ General Construction ☐ Plumbing ☐ Mechanical ☐ Electrical ☐ Other ☐	

Specification Reference:	**Drawing Reference:**

Description, complete with backup information as needed to fully convey the issue: ☐ **Sketch/Information Attached**

Contractor's Proposed Solution: ☐ **Sketch/Information Attached**

Impact on Cost:	**Impact on Schedule:**

Trades/Specialty Contractors Affected:

Trades/Specialty Contractors Coordinated With:

Submitted By:	**Requested Date of Response:**

Architect/Engineer's Response: ☐ **ID No._____** ☐ **Attached**
☐ **Sketch/Information Attached**

By:_____ **Date:**_____

Document2

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for preparing a combined Contractor's Construction Schedule.
2. Section 014000 "Quality Requirements" for schedule of tests and inspections.
3. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

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1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at weekly intervals.

G. Unusual Event Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing work stages area separations interim milestones and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

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1.6 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion .

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
   a. Securing of approvals and permits required for performance of the Work.
   b. Temporary facilities.
   c. Construction of mock-ups, prototypes and samples.
   d. Owner interfaces and furnishing of items.
   e. Interfaces with Separate Contracts.
   f. Regulatory agency approvals.
   g. Punch list.
3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work under More Than One Contract: Include a separate activity for each contract.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Work Restrictions: Show the effect of the following items on the schedule:
   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.

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d. Partial occupancy before Substantial Completion.
e. Use-of-premises restrictions.
f. Provisions for future construction.
g. Seasonal variations.
h. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
   a. Subcontract awards.
   b. Submittals.
   c. Purchases.
   d. Mockups.
   e. Fabrication.
   f. Sample testing.
   g. Deliveries.
   h. Installation.
   i. Tests and inspections.
   j. Adjusting.
   k. Curing.
   l. Startup and placement into final use and operation.
7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
   a. Structural completion.
   b. Permanent space enclosure.
   c. Completion of mechanical installation.
   d. Completion of electrical installation.
   e. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion .

1. Temporary enclosure and space conditioning.

F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Final Completion percentage for each activity.

I. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain

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compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

J. Distribution: Distribute copies of approved schedule to Architect , Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.8 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for the Notice of Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.9 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice of Award.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.10 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.

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17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit 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. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: 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, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
5. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
6. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
8. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

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1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
   a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Submittal Category: Action; informational.
   d. Name of subcontractor.
   e. Description of the Work covered.
   f. Scheduled date for Architect's and Construction Manager's final release or approval.

1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

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a. Architect , through Construction Manager, will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 10 days for review of each resubmittal.
4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow [**15**] days for review of each submittal. Submittal will be returned to Construction Manager, through Architect, before being returned to Contractor.
   a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

1.7 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Standard color charts.
   d. Statement of compliance with specified referenced standards.
   e. Testing by recognized testing agency.

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f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams that show factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
   a. Project name and submittal number.
   b. Generic description of Sample.
   c. Product name and name of manufacturer.
   d. Sample source.
   e. Number and title of applicable Specification Section.
   f. Specification paragraph number and generic name of each item.
3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect , through Construction Manager, will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit 2 sets of Samples. Architect and Construction Manager will retain 1 Sample sets; remainder will be returned.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

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D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

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1.8 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and 1 paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp . Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required.

1. PDF Submittals: Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action .
2. Paper Submittals: Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action .

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect and Construction Manager will discard submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection 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 quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:

1. Section 012100 "Allowances" for testing and inspection allowances.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. 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, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:
   a. Verify selections made under Sample submittals.
   b. Demonstrate aesthetic effects.
   c. Demonstrate the qualities of products and workmanship.

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d. Demonstrate successful installation of interfaces between components and systems.
e. Perform preconstruction testing to determine system performance.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. 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.

J. 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. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

1.4 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is 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.

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1.6 ACTION SUBMITTALS

A. Mockup Shop Drawings:

1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

D. Reports: Prepare and submit certified written reports and documents as specified.

E. Permits, Licenses, and Certificates: For Owner's record, 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.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award , and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent .

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

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1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address 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 inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.

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5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

G. 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 Contractor's responsibilities, including the following:

1. Provide test specimens representative of proposed products and construction.
2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
4. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
5. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect , through Construction Manager, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

H. 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 of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect or Construction Manager.
3. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's and Construction Manager's approval of mockups before starting corresponding Work, fabrication, or construction.

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a. Allow seven days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

1.11 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 inspection they are engaged to perform.
2. Payment for these services will be made from testing and inspection allowances specified in Section 012100 "Allowances," as authorized by Change Orders.
3. 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. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.
   a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect , Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect , Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations 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 duties of Contractor.

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E. 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 Section 013300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. 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 inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner , as indicated in the Statement of Special Inspections attached to this Section, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect , Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect , through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "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.

C. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."

D. "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."

E. "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.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "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.

1.2 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.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

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1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 011200 "Multiple Contract Summary" for responsibilities for temporary facilities and controls for projects utilizing multiple contracts.
3. Section 012100 "Allowances" for allowance for metered use of temporary utilities.

1.2 USE CHARGES

A. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.

B. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

C. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

C. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

D. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by Owner. Include the following:

1. Methods used to meet the goals and requirements of Owner.
2. Concrete cutting method(s) to be used.
3. Location of construction devices on the site.
4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with Owner.

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1.4 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized-steel bases for supporting posts.

B. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices:

1. Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
2. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 13 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

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1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
   a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
   b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

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E. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

F. Storage and Staging: Use designated areas of Project site for storage and staging needs.

G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

H. Waste Disposal Facilities:

1. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas, so no evidence remains of correction work.

L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control:

1. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, in accordance with erosion- and sedimentation-control Drawings .
   a. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
   b. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   c. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.

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d. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection:

1. Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."

F. Site Enclosure Fence: Before construction operations begin , furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations .
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.

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3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
   a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
   b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
   c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
2. Section 012100 "Allowances" for products selected under an allowance.
3. Section 012300 "Alternates" for products selected under an alternate.
4. Section 012500 "Substitution Procedures" for requests for substitutions.
5. Section 014200 "References" for applicable industry standards for products specified.
6. Section 01770 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

A. Products: Items obtained 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. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, 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. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other

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requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:
   a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
   a. Name of product and manufacturer.
   b. Model and serial number.
   c. Capacity.
   d. Speed.
   e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

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1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 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.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, 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.

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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 meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
    a. Submit additional documentation required by Architect through Construction Manager in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
    a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 016400 - OWNER FURNISHED PRODUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Construction Drawings, Technical Specifications, Addenda, and general provisions of the Contract, including Contract General Conditions and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Requirements for installing Owner-furnished products, including providing miscellaneous items and accessories for a complete, functioning installation.

1.3 RELATED SECTIONS

A. Section 015800 - Project Identification and Signage: Owner-furnished, Contractor-installed (OFCI) temporary signage.

1.4 PRODUCT HANDLING

A. Protection: Contractor shall use means necessary to protect the materials of this Section before, during, and after installation and to protect completed Work, including products installed by others.

B. Replacements: In the event of damage, Contractor shall immediately repair all damaged and defective Work to satisfaction of Owner's Representative, at no change in Contract Time and Contract Sum.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Products Identified with Contractor Responsibility for Installation:

1. Contractor shall verify mounting and utility requirements for accepted products.

2. Contractor shall provide mounting and utility rough-ins for OFCI products.
   a. Rough-in locations, sizes, capacities and similar type shall be as indicated and required by product manufacturers.
   b. If the Owner substitutes items similar to those scheduled there shall be no change in rough-in cost, unless substitution occurs after rough-in has been completed or rough-in involves other mounting requirements, utilities of different capacity than those required by item originally specified.

3. For items Designated to Be Owner- or Vendor-Furnished: Owner or its vendor will furnish manufacturer's literature or information, shop drawings, or appropriate information for preparing required shop drawings.

B. Installation Instructions: Approved manufacturer's printed descriptions, specifications and recommendations shall govern the Work, unless specifically indicated otherwise.

C. Electrical Components: Contractor shall comply with requirements specified in Division 26 - Electrical, including National Electrical Code (NEC).

D. Plumbing and HVAC Components: Contractor shall comply with requirements specified in Division 22 – Plumbing and Division 23 – HVAC.

2.2 OWNER-FURNISHED/CONTRACTOR-INSTALLED PRODUCT REQUIREMENTS

A. Products Furnished by Owner and Installed by Contractor:

1. Contractor shall coordinate delivery of OFCI products. Owner will furnish products to coincide with construction schedule.

2. Owner will:
   a. Furnish standard integral components of products.
   b. Deliver products to site. Contractor shall assist Owner in offloading products.

3. The Contractor shall:
   a. Receive products at site and give written receipt for product at time of delivery, noting visible defects and omissions; if such declaration is not given, the Contractor shall assume responsibility for such defects and omissions.
   b. Store products until ready for installation and protect from loss and damage.
   c. Uncrate, assemble and set products in place.
   d. Install products in accordance with manufacturer's recommendations, instructions and shop drawings under supervision of manufacturer's representative where specified, supplying labor and material required and making mechanical, plumbing and electrical connections necessary to operate equipment.
   e. Where so specified, installation shall be only by installer approved by manufacturer. If known, approved installer is identified on the Drawings or in the Specifications.
   f. Provide and install backing for all products weighing 20 pounds or more.
   g. Treat all Owner or Vendor supplied products with the same care as all Contractor furnished items.

B. Products Furnished and Installed by Owner:

1. Contractor prepare; vendor install:
   a. General: Contractor shall coordinate deliveries of vendor-supplied products. Vendor will furnish products to coincide with the construction schedule.
   b. Vendor will:
      1) Furnish standard integral components of products.
      2) Deliver products to site.
      3) Make connections to roughed-in utilities.
   c. Contractor shall:
      1) Receive products at site and give written notice of receipt of each product at time of delivery, noting visible defects.
      2) Provide rough-in of utility products in accordance with manufacturer's recommendations, instructions and shop drawings under supervision of the manufacturer's representative where specified.
      3) Provide and install backing for all products weighing 20 pounds or more.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to commencing Work, Contractor shall verify that Work specified in other Sections has been properly completed and installed as specified to allow for installation of all materials and methods required of this Section.

2. Contractor shall verify that new and existing products and conditions are satisfactory for installation or relocation of OFCI products. If unsatisfactory conditions exist, do not commence the installation until such conditions have been corrected.

B. Discrepancies:

1. In the event of discrepancy, Contractor shall immediately notify the Owner's Representative.

2. Contractor shall not proceed with installation in areas of discrepancy until all such discrepancies have been resolved.

3.2 INSTALLATION

A. Contractor shall relocate and reinstall existing products in accordance with Contract Documents and reviewed shop drawings, original manufacturer's instructions and recommendations if applicable and as directed.

B. Contractor shall install Owner-furnished products in accordance with reviewed shop drawings and manufacturer's printed instructions, as applicable.

3.3 ADJUSTING AND CLEANING

A. Contractor shall adjust products as necessary and as directed by Owner's Representative.

B. Contractor shall clean all new and relocated OFCI products.

C. Contractor shall protect OFCI products from damage until Contract Completion.

3.4 LIST OF OWNER FURNISHED PRODUCTS

A. Owner will provide HVAC Contractor with HVAC equipment and controls for HVAC contractor to install. See attached spec sections 016400.1 Trane Omnia Equipment and Controls Scope (Stony Point), 016400.2 Trane Omnia Equipment and Controls Scope (Thiells), and 016400.3 Trane Omnia Equipment and Controls Scope (West Haverstraw) for full description.
   a. Stony Point
      i. Rooftop unit and curbs for RTU-1, RTU-2, RTU-3.
      ii. Air-Cooled Condensing Units
      iii. Unit Ventilators
      iv. Exhaust Fans
   b. Thiells
      i. Air-Cooled Condensing Units
      ii. Unit Ventilators
      iii. Exhaust Fans
   c. West Haverstraw
      i. Air-Cooled Condensing Units
      ii. Unit Ventilators
      iii. Exhaust Fans

B. Owner will contract with Siemens via state contract for controls installation and BMS integration.

END OF SECTION

Trane Omnia Equipment and Controls Scope
Stony Point Elementary School

Proposal Prepared For:
North Rockland Central School District
65 Chapel St
Garnerville, NY 10923

Local Trane Office:
Trane U.S. Inc.
19 Chapin Road, Bldg B, Suite 200
Pine Brook, NJ 07058

Omnia Contract Number:
B6-uZ0AAK-24-011

Date: February 24, 2025

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Prepared For:
North Rockland CSD

Job Name:
North Rockland CSD Stony Point ES Univent Replacement

Delivery Terms:
Freight Allowed and Prepaid - F.O.B. Jobsite

Date: February 24, 2025

Proposal Number: B6-256533-37252-1
OMNIA-COOP: RACINE COUNTY#3341
Opportunity ID: 7965341

Engineer: Greenman Pedersen Incorporated

Payment Terms: Net 30 Days

Trane U.S. Inc. is pleased to provide the following proposal for your review and approval.

This Scope of Work will be executed based on Trane's scope of work proposed herein, which is a clarification of the plans and specifications, and adheres to Trane's "Standard Contract Terms and Conditions" only; any other document and/or contract will not bind and/or supersede these conditions.

Building Automation System

This proposal has been developed from the following documentation:

- Plans and Specs prepared by: Greenman Pedersen, Inc
- Mechanical drawings SPES-M-003 through SPES-M-305 dated 05/10/24
- Electrical drawings SPES-E-061 through SPES-501 dated 05/10/24
- Specification sections 230923, 230924 & 230993
- Additional drawings reviewed: No additional documents provided to Trane at the time of this bid. All additional work as a result of these documents that is not listed below is not included from this bid.

Trane's pricing accounts for the following considerations:

- **Straight Time Labor**
- Trane's Electrical field installation will be performed by: **Union Electrical Contractor**
- Electrical Installation: Refer to Electrical Clarification section below
- **1 Year** parts and labor warranty against defects in material and workmanship on all new, Trane provided, field installed, DDC controllers and components.
- **24 Hours of Controls Technician Assistance for integration with the Siemens Building Management System.**
- **24 Hours of Commissioning Assistance of 3rd Party Commissioning Agent.**
- Project to be completed by **August 30, 2025**; escalation costs incurred after this date are not included and will be in addition to the Total Net Price(s) stated below. Added costs will depend upon the remaining scope identified at that time.

The following is Trane's scope of work:

1) TRANE BACNET GATEWAY EQUIPMENT:

a) **Trane will provide a BACnet gateway for integration into the existing Siemens Enterprise Level Building Management System. Siemens will be able to communicate with this system via BACnet/IP. Siemens will need to provide pricing to the district to integrate the new Trane system.**

b) Trane to setup operator interface for proper interaction with the BAS. User workstation interface will be:
   i) **Owner furnished or provided by Siemens**

c) **Graphics to be provided by Siemens.**

2) ASSOCIATED MECHANICAL EQUIPMENT:

a) **VRF System.** BAS will provide monitoring, control, and alarming of available points.

i. Includes field installation of the following devices:
   a. CAT-6 Wiring to Centralized Controller. Trane will provide integration to the VRF Centralized Controller via BACnet/IP.
   b. Interlock to **(8)** Outdoor Air-Cooled Condensing Unit(s)

ii. Low Voltage Daisy Chain Communication Wiring (16Ga TSP) to the following components:
   a. **(16)** Indoor Units
   b. **(8)** Branch Controllers
   c. **(44)** LEV Controllers

iii. Wiring to the following components associated with **each** Indoor Unit:
   a. **(16 total)** Space Thermostat [Furnished by manuf.]
   b. **(5 total)** Inline Booster Fans to associated indoor unit
      a. Requires installation of Relay Module

b) (44) Unit Ventilators (UV-X) with factory mounted DDC controllers. BAS will provide monitoring, control, and alarming of available points and field installation of the following devices:
   i. Room temperature sensor [wireless]
   ii. Return air temperature sensor
   iii. Outside air temperature sensor
   iv. Hot water control valve
   v. **(1 per UV)** LEV Controller with **115V:208V** Step UP Transformer
   vi. **(1 per UV)** LEVs Valves (On DX Coil)
   vii. **(4 per UV)** VRF sensors per LEV Control Box. Each sensor shall be wired back to the LEV Control Box. This includes:
      1) **(2 per UV)** Air Thermistors
      2) **(2 per UV)** Refrigerant sensors
   viii. Interlock between LEV Control Box & UV DDC Controller
   ix. Communication bus [wireless – Factory installed WCI]

c) (28) Exhaust fan (EF-x) control to include Start/Stop control and Status monitoring. To include the filed installation of (6) DDC Controllers, Field Installed WCI and Enclosures.

3) PROJECT SPECIFIC NOT INCLUDED:

a) Existing Building Management System checkout and testing. Testing, if required, must be provided by Siemens.
b) Graphics. Graphics will be provided by Siemens.
c) Upgrades to existing control systems.
d) All work associated with existing building equipment.
e) All work associated with any existing building management systems.
f) Integration into existing Building Management Systems. Work must be provided by Siemens, if required.
g) All work associated with existing pneumatics.
h) All work associated with demolition.
i) All low voltage installation, controls integration, and furnishing of end devices associated with the [3] Rooftop units on this project. Low voltage installation shall be provided by Siemens. End devices (zone sensors, duct sensors, valves, etc. shall be provided by Siemens. BACnet integration of these units shall be provided by Siemens.

4) TRANE BUILDING AUTOMATION SYSTEM (BAS) CLARIFICATIONS:

a) **Project Management, Design Engineering, Field Engineering, and Operator Training Labor:**
   i. Trane has included factory-trained BAS Project Management, Project Engineering, and Field Technician labor required to deliver a functional control system as qualified in this proposal. Mechanical startup in not included unless otherwise specified above.
   ii. Trane to provide factory standard engineered control submittals including product data sheets, and associated mechanical system sequence of operations. Any additional modifications or formatting that is not in the plans and specification are not included in this proposal.

iii. Project Management and field installation labor will be provided based upon project schedule and mechanical equipment field readiness.
iv. Trane has included an allowance, as stated above, for a field technician to assist the Balancing Contractor (BC) to connect their laptop for hydronic and air systems testing. This assistance includes helping the BC review the site, connect to the network and discover all devices. This assistance **DOES NOT** include a technician to work with the BC as they perform their work. The BC MUST possess their own laptop with a licensed copy of Trane balancing tool software. Contractor MUST provide Trane two weeks' notice for prior to scheduling. Trane will provide Time & Material billing based on published labor rates beyond the allotted allowance hours.
v. Trane to provide O&M manuals and as-built control submittal drawings upon completion of the project
vi. BAS Operator training allowance included as stated above. Additional training support hours are available on a T&M basis upon request. Training to be completed within (3) month of system acceptance.

b) **Electrical installation work clarifications:**

i. Trane has included 120 vac power wiring for **(0)** field mounted panels and electronic digital controllers in our scope of work. All other 120 vac end devices and panels are to be installed and wired by Division 26 Project Electrical Contractor, and **are not** included in this proposal.
ii. Trane is excluding power wiring of any kind (not listed above). Including but not limited to equipment, VAV boxes, DDC control panels and 120 vac control valve actuators
iii. BAS control wiring will be installed in EMT conduit in exposed mechanical spaces. For all other locations (i.e. ceilings and walls), wiring shall be installed with properly supported plenum rated cable outside of conduit.
iv. Outdoor control wiring shall be installed in galvanized rigid conduit or outdoor rated EMT that meets the National Electric Code requirements for the location of the project.
v. Trane has not included any labor associated with trenching required for underground conduits
vi. Trane electrical installation labor includes cleanup labor to ensure the work areas are clean of debris at the end of each working day. It has been assumed by Trane, the GC/CM for the project will be providing central collection areas for all project related debris.

c) **Warranty/Service Agreement**

i. Includes a one-year parts & labor warranty against defects in material & workmanship on all new, Trane provided, field-installed, DDC controllers and components. Warranty repair and replacement labor will occur during normal working hours.
ii. Warranty will end 18 months from shipment date or 12 months beginning with the date of beneficial use, whichever comes first.
iii. In the event of construction phasing of this project, each DDC system in a completed Phase will be warranted for 12 months, beginning with the date of beneficial use.
iv. BAS parts & labor warranty applies to field-installed controls only. Please refer to the equipment proposal for warranty coverage of the DDC controls factory supplied with the HVAC equipment.
v. Extended warranties are available upon specific requests
vi. Trane has not included an in-warranty service agreement within this proposal that includes Trane Intelligent Services, and/or Occupancy Adjustment visits to ensure proper operation during the warranty period described above.

d) **Clarifications:**

i. Trane is unable to release control submittals, order any materials or provide field labor until the tax determination for the project has been confirmed. If the project is exempt of taxes, Trane must be given appropriate state exempt forms at the onset of the project
ii. Trane will begin control submittals after the receipt of all approved Trane, non-Trane equipment submittals, and a detailed project schedule.
iii. Trane's BAS proposal and pricing is based upon Trane providing the HVAC equipment, with factory installed & tested controls, as described in this proposal. If non-Trane HVAC equipment is provided, Trane reserves the right to modify this proposal and subsequent pricing based upon the mechanical equipment being provided.
iv. Non-Trane systems being integrated to the BMS will come with the necessary material, labor and technical support to facilitate the integration to the BMS at no cost to Trane.
v. Trane has included our standard start-up and checkout labor practices for this project. Upon requiring coordination, documentation, and/or demonstration of systems performance to a designated Commissioning Agent Trane reserves the right to modify our pricing. A meeting is to be established to outline the method and documentation required for the commissioning work required.

e) **NOT Included:**

i. Providing, wiring, controlling or monitoring of any equipment/devices not included in the above scope
ii. Furnishing of PC or laptop computer for interface with BAS (refer to scope of work above).
iii. Electrical installation labor and material not included in the above scope.
iv. Interfacing to another BAS, to include any third party devices, software/hardware and any associated wiring and labor associated with integration
v. Startup, testing, troubleshooting or commissioning of equipment and devices not furnished by Trane. This includes miscellaneous control wiring provided by Trane for third party items
vi. Furnishing Variable Frequency Drives, starters, HOA switches, disconnects and/or associated electrical power wiring or integration.
vii. Installation of valves, dampers, pipe pressure taps, temperature sensor wells, pressure sensor/switch/transducer line sensor tubing and air flow measuring station
viii. Furnishing of control dampers
ix. Furnishing or installation of manufacturer supplied Boiler equipment, safeties, integral controls, gas train controls emergency shutoff switches, remote components and boiler circulating pumps control and associated wiring
x. Installation and furnishing of Boiler Safety Glass Shutdown and associated wiring
xi. Boiler combustion dampers, control and associated wiring
xii. Humidifier, Steam Generator, associated instruments, safety wiring and associated devices, utility piping, electrical power wiring, remote panel installation, or start-up labor
xiii. Stairwell pressurization control and any associated wiring
xiv. Air compressor and associated field devices with existing pneumatic system
xv. Sales Taxes
xvi. Alternate(s)/Add Alternate(s) are not included in the base scope
xvii. Fire, Smoke and/or Fire/Smoke dampers and any associated wiring
xviii. Exhaust Fans Dampers and associated wiring
xix. Smoke detectors; interface wiring with fire alarm system; smoke purge initiation
xx. Trenching required for underground conduit installation
xxi. Any cost associated with liquidated damages
xxii. Bid, Performance, or Payment Bonds
xxiii. Access doors
xxiv. Calibration certificates for any control devices
xxv. Demolition; excavation, roof penetrations; ceiling tile removal or replacement, cutting, patching and painting
xxvi. Checkout, repair, replacement or warranty of existing equipment
xxvii. Accelerated shipping costs
xxviii. Temporary, Standby or Overtime Labor; *All work figured to be done during normal working hours(7am to 3:30pm)*

Mechanical Equipment

Tag Data - Horizon™ - Outdoor Air Unit (Qty: 3)

Item	Tag(s)	Qty	Description
A1	RTU-1	1	D015 Horizon™ - Outdoor Air Unit (Revision 6)
A2	RTU-2, RTU-3	2	B10B Horizon™ - Air Source Heat Pump (OAB)

Product Data - Horizon™ - Outdoor Air Unit (Revision 6)
Item A1 Tag(s): RTU-1

Unit Voltage: 208-3-60
Curb Selection: 2" Vibration Isolation curbs (Field Installed by contractor
Airflow Configuration: Vertical Discharge/Vertical Return
Reheat: Fin & Tube Modulating HGRH
Compressor: Digital Scroll-1st Circuit Only
Outdoor Coil Type: ASHP Fin & Tube
Capacity Control: R-454B - Low GWP Refrigerant & No RCC Valve
Heat Type - Primary: No Heat
Supply Fan Motor Type: Direct Drive w/VFD
Exhaust Fan Motor Type: Direct Drive w/VFD
Unit Controls: Discharge Air Control - UC600
Building Interface: BACnet
Filter Options: MERV-8,30%
Damper Options: Modulating OA & RA Dampers w/Economizer
Exhaust Dampers: Barometric Relief Dampers
Electrical Options: Non-Fused Disconnect "Circuit Breaker"
Condenser Fan Options: Active (VFD) Head Pressure Low Ambient Control
Hailguards: Hailguards
Supply Discharge Air Sensor (FLD)
2-inch Double Wall Construction
Stainless Steel Drip Pan
5-year compressor warranty
Startup & Labor Warranty by NJ Trane Service

NOT Included: Smoke detectors, control wiring, gas piping specialties, external vibration isolation, rigging/receiving, spare parts and service.

Product Data - Horizon™ - Air Source Heat Pump (OAB)
Item A2 Tag(s): RTU-2, RTU-3

Unit Voltage: 208-3-60
Airflow Configuration: Vertical Discharge/Vertical Return
Hot Gas Reheat: Modulating
Compressor: Digital Scroll Primary Circuit
Condenser: Air Cooled Variable Speed Head Pressure Low Ambient Control
Capacity Control: R-454B - Low GWP Refrigerant & No RCC Valve
Indoor Blower Motor: Direct Drive w/VFD
Heat Type: Electric - Staged
Fuel Type: Electric - Open Coil
208-3V Electric Heater: 28
Unit Controls: Trane UC600 - Single-Zone VAV Control w/ BACnet w/ Display
Powered Exhaust: Direct Drive w/VFD & Gravity Damper
Damper Options: 2-Position Outdoor and Return Air Dampers
Filters: MERV-13
Smoke Detectors: Return
Electrical Options: Dual Point Power w/ 115v Outlet
Air Flow Monitoring: IFM Piezo Ring and PE Piezo Ring/Tap
Accessories: Condenser Hailguard
Curb Selection: Aux Mod 2" Vibration Isolation (Field Installed by contractor)
Supply Discharge Air Sensor (FLD)
2-inch Double Wall Construction
Stainless Steel Drip Pan
5-year compressor warranty

Startup & Labor Warranty by NJ Trane Service

NOT Included: Smoke detectors, control wiring, gas piping specialties, external vibration isolation, rigging/receiving, spare parts and service.

Tag Data - Heating Coils (Qty: 1)

Item	Tag(s)	Qty	Description	Model Number
B1	HWC-1	1	Heating coil (HTCL)	D5WB36

Product Data - Heating Coils
Item: A1 Qty: 1 Tag(s): HWC-1

Drainable at header
5W coil 5/8" full row serpentine
Heating coil
Galvanized steel casing (Std)
36" (914 mm) coil height
35" (889 mm) finned length
Aluminum fins
Warranty By NJ Trane Service

NOT Included: Transition ductwork, coil casing, controls, valves, piping specialties, drain pan, rigging/receiving, spare parts and startup/service.

Tag Data - VUVE Unit Ventilator (UV) (Qty: 44)

Item	Tag(s)	Qty	Description	Model Number
C1	UV-102, UV-106, UV-106a, UV-107, UV-108, UV-123B, UV-149, UV-229	8	VUVE Unit Ventilator (UV)	VUVE0750
C2	UV-112, UV-113, UV-114, UV-115, UV-116, UV-117, UV-119, UV-120, UV-121, UV-122, UV-133, UV-134, UV-135, UV-223, UV-224, UV-227	16	VUVE Unit Ventilator (UV)	VUVE1500
C3	UV-136	1	VUVE Unit Ventilator (UV)	VUVE1000
C4	UV-126, UV-127, UV-128, UV-129, UV-130, UV-140, UV-218, UV-220, UV-222, UV-225, UV-226, UV-228, UV-234, UV-235, UV-237, UV-238, UV-239, UV-2240	19	VUVE Unit Ventilator (UV)	VUVE1250

Product Data - VUVE Unit Ventilator (UV)
All Units

Vertical unit ventilator
115v/60hz/1ph
Return air front/fresh air back
DX cooling with HW heating
Lev Kit cooling coil
ECM & Low FLA
Toggle disconnect switch
2-Way, Modulating
Discharge grille with wire mesh
Modulating outside air damper
Symbio 400-B with Air-Fi WCI
Wireless sensor
21.25" depth with full sheetmetal back
21.25" deep end covers
Insulated front panel
Deluxe Piping Package
Auxiliary drain pan
Throwaway filter (C1-750 CFM ONLY)
MERV 13 FILTER (C2, C3, C4 ONLY)
Startup and Warranty by NJ Trane Service

NOT Included: Smoke detectors, crossover piping, wall sleeves, wall boxes, recessing flange, shelving, external vibration isolation, rigging/receiving, subbases, spare parts.

Tag Data - 18 inch piping cabinet (Qty: 44)

Item	Tag(s)	Qty	Description	Model Number
D1	18 inch	44	**18 inch piping cabinet**	SHLB5700

Product Data - Unit Ventilator Shelving Units
Item: D1 Qty: 44 Tag(s): 18-inch piping cabinet

18-inch piping cabinet (Field Installed by contractor)
21.25" [540mm] deep piping compartment
Louver Front Kickplate (no side) (Field Installed by contractor)
Color – To be confirmed by Architect

NOT Included: Top plate, installation, rigging/receiving, subbase, spare parts and startup/service/warranty labor.

Tag Data - Linear Expansion Valve Kit (Qty: 44)

Item	Tag(s)	Qty	Description
E1	UV-129, UV-130, UV-127, UV-128, UV-126, UV-121, UV-115, UV-116, UV-117, UV-119, UV-120, UV-122, UV-113, UV-114, UV-112, UV-140, UV-218, UV-220, UV-222, UV-227, UV-228, UV-224, UV-223, UV-225, UV-226, UV-234, UV-239, UV-240, UV-238, UV-237, UV-236, UV-235	32	Linear Expansion Valve Kit (JV_LEV)
E2	UV-123B, UV-108, UV-107, UV-106A, UV-106, UV-102, UV-136, UV-149, UV-229	9	Linear Expansion Valve Kit (JV_LEV)
E3	UV-135, UV-134, UV-133	3	Linear Expansion Valve Kit (JV_LEV)

Product Data - Linear Expansion Valve Kit
All Units

1 PAC-AH001-1 LEV Controller

Item: E1 Qty: 32 Tag(s): UV-129, UV-130, UV-127, UV-128, UV-126, UV-121, UV-115, UV-116, UV-117, UV-119, UV-120, UV-122, UV-113, UV-114, UV-112, UV-140, UV-218, UV-220, UV-222, UV-227, UV-228, UV-224, UV-223, UV-225, UV-226, UV-234, UV-239, UV-240, UV-238, UV-237, UV-236, UV-235

1 PAC-LV48AC-1

Item: E2 Qty: 9 Tag(s): UV-123B, UV-108, UV-107, UV-106A, UV-106, UV-102, UV-136, UV-149, UV-229

1 PAC-LV24AC-1

Item: E3 Qty: 3 Tag(s): UV-135, UV-134, UV-133

1 PAC-LV60AC-1

Tag Data - VRF Indoor Unit (Qty: 16)

Item	Tag(s)	Qty	Description
F1	CC-1, CC-2, CC-3, CC-118	4	VRF Indoor Unit (JV_IDU)
F2	CC-111, CC-101, CC-110, CC-100, CC-137, CC-142, CC-143A, CC-150, CC-147, CC-230	10	VRF Indoor Unit (JV_IDU)
F3	CC-132,CC-132A	2	VRF Indoor Unit (JV_IDU)

Product Data - VRF Indoor Unit
All Units

1 TAR-41 Programmable Thermostat (Field Installed by contractor)
1 PAC-SH59KF-E High Eff Filter Element (Field Installed by contractor)
1 PAC-SJ41TM-E-MULTI-FUNCTION CASEMENT (Field Installed by contractor)
1 TLP-41EAEU-GRILL FOR TPLFY-EP & TPLA-7 INDOOR (Field Installed by contractor)

Item: F1 Qty: 4 Tag(s): CC-1, CC-2, CC-3, CC-118

TPLFYP015EM142A 4-way Ceiling Cassette Indoor Unit

Item: F2 Qty: 10 Tag(s): CC-111, CC-101, CC-110, CC-100, CC-137, CC-142, CC-143A, CC-150, CC-147, CC-230
TPLFYP012EM140B 4-way Ceiling Cassette Indoor Unit

Item: F3 Qty: 2 Tag(s): CC-132, CC-132A
TPLFYP006EM142A 4-way Ceiling Cassette Indoor Unit

Tag Data - VRF Outdoor Unit (Qty: 8)

Item	Tag(s)	Qty	Description
G1	ACCU-1A, ACCU-1B	2	VRF Outdoor Unit (JV_ODU)
G2	ACCU-2	1	VRF Outdoor Unit (JV_ODU)
G3	ACCU-3A, ACCU-6	2	VRF Outdoor Unit (JV_ODU)
G4	ACCU-3B	1	VRF Outdoor Unit (JV_ODU)
G5	ACCU-4, ACCU-5	2	VRF Outdoor Unit (JV_ODU)

Product Data - VRF Outdoor Unit
All Units

Item: G1 Qty: 2 Tag(s): ACCU-1A, ACCU-1B
TURYE2643BN41A – Outdoor System
- TURYE1443AN41AN - MODULE#1 Outdoor Unit
- TURYE1203AN41AN - MODULE#2 Outdoor Unit

Item: G2 Qty: 1 Tag(s): ACCU-2
TURYE2883BN41A – Outdoor System
- TURYE1443AN41AN - MODULE#1 Outdoor Unit
- TURYE1443AN41AN - MODULE#2 Outdoor Unit

Item: G3 Qty: 2 Tag(s): ACCU-3A, ACCU-6
TURYE2163BN41A – Outdoor System
- TURYE1203AN40AN - MODULE#1 Outdoor Unit
- TURYE0963AN41AN - MODULE#2 Outdoor Unit

Item: G4 Qty: 1 Tag(s): ACCU-3B
TURYE0963AN41AN – Outdoor System
- TURYE0963AN41AN - MODULE#1 Outdoor Unit

Item: G5 Qty: 2 Tag(s): ACCU-4, ACCU-5
TURYE1923BN41A – Outdoor System
- TURYE0963AN41AN - MODULE#1 Outdoor Unit
- TURYE0963AN41AN - MODULE#2 Outdoor Unit

Tag Data - VRF Accessory (Qty: 1)

Item	Tag(s)	Qty	Description
H1	VRF Accessory	1	VRF Accessory (JV_ACC)

Product Data - VRF Accessory
Item: H1 Qty: 1 Tag(s): VRF Accessory
4 CMY-R200NCBK-TWINNING KIT (R2 EP/P192 TO 240 T/YSNU) (Field Installed by contractor)
3 CMY-R300NCBK-TWINNING KIT (R2 EP/P264 TO 336 T/YSNU) (Field Installed by contractor)
8 CMY-R302S-G1-REDUCER JA1 TYPE BC CONTROLLER (Field Installed by contractor)
80 BV38BBSI-3/8" BALL VALVE, BRAZED (Field Installed by contractor)
80 BV58BBSI-5/8" BALL VALVE, BRAZED (Field Installed by contractor)
30 WDN-2-Front and Rear Wind Deflectors for LG units (Field Installed by contractor)
8 SWDN-1-Side Wind Deflectors (Field Installed by contractor)
15 LAHN-3-Low Ambient Hood Assembly (master) for LG units (Field Installed by contractor)
15 LAHN-4-Low Ambient Hood Assembly (subordinate) for LG units (Field Installed by contractor)

Tag Data - VRF Branch Controller (Qty: 1)

Item	Tag(s)	Qty	Description
I1	VRF Branch Co	1	VRF Branch Controller (JV_BCU)

Product Data - VRF Branch Controller
Item: I1 Qty: 1 Tag(s): VRF Branch Controller
4 Accessory 8 Branch Main BC (Field Installed by contractor)
4 Accessory 12 Branch Main BC (Field Installed by contractor)

Tag Data - VRF Controls (Qty: 1)

Item	Tag(s)	Qty	Description
J1	VRF Controls	1	VRF Controls (JV_CTRL)

Product Data - VRF Controls
Item: J1 Qty: 1 Tag(s): VRF Controls
1 LIC-BACNET EXPANSION
1 LIC-BACNET MASTER
1 TE-200A Centralized Controller (Field Installed by contractor)
1 TE-50A Expansion (Field Installed by contractor)

Proposal Clarifications and Exclusions:

- Proposal above does not include rigging and receiving of equipment. North Rockland CSD is responsible for receiving and unloading equipment.
- Proposal above does not include storage of equipment.
- Proposal above does not include extended warranties or delayed startup.
- Proposal above does not include stands, springs, rails, or pads for the VRF outdoor condensing units.
- Proposal above does not include shelving of any kind for the unit ventilators.
- Proposal above does not include VRF line sets. Refrigerant Piping is by the Installing Contractor.
- Proposal above does not include spare filters.
- Confirm Unit Ventilator Heating Control valve is 2 way or 3 ways prior to ordering.
- Confirm low FLA option for unit ventilators prior to releasing.
- Confirm if subbases are required on all unit ventilators prior to releasing.
- Installation of all equipment is to be provided by others.
- Installing contractor is responsible for procuring and installing booster fans for the cassettes that are pulling fresh air directly from outside air louvers and are not served by other equipment. Power to the booster fans shall be provided by the Div 26 Electrical Contractor.
- Please refer to the complete scope for additional exclusions per product type.

Installation Responsibilities:

1) **The Installing Mechanical Contractor** is responsible for the removal of any existing DX valves factory-installed on-unit ventilator.
2) **The Installing Mechanical Contractor** is responsible for brazing of the Mitsubishi VRF LEV valve assemblies to the unit ventilator.
3) **Trane Controls** is responsible for field mounting of the Linear Expansion Valve Control Boxes.
4) **Trane Controls** is responsible for field installation of qty (4) VRF sensors for each LEV Control Box. This includes (2) air thermistors and (2) refrigerant sensors and wiring back to Linear Expansion Valve Control Boxes.
5) **Trane Controls** is responsible for wire interlock between LEV controller and LEV valve assemblies
6) **Trane Controls** is responsible for wire interlock between LEV controller and UC controller, and UC Controller to wall thermostat (if applicable).
7) **Trane Controls** is responsible for all M-net wiring.
8) **The Licensed Electrical Contractor** is responsible for bringing 208-230V power to the LEV Controller, in addition to the Unit Ventilator power.
9) **Trane Controls** is responsible for programming of UC Controller (if applicable).
10) **Trane Controls** is responsible for any interlock of 3rd party devices with UC Controller (if applicable)
11) **Trane Service** is responsible for the start-up of the traditional air handling device.

12) **The Installing Mechanical Contractor** is responsible for the start-up of the VRF components.
13) **Trane Controls** is responsible for the addressing of the VRF system
14) **The Installing Mechanical Contractor** is responsible for providing and installing unit ventilator condensate pumps.
15) **The Licensed Electrical Contractor** is responsible for providing power to condensate pumps, when required.

Not Included: Control integration/wiring, smoke detectors, refrigeration tees, filter boxes, wind baffles(unless otherwise noted), hail/snow guards, flow switches, secondary drain pans, secondary condensate overflow sensors, external condensate pumps (unless otherwise noted), disconnects, refrigerant piping specialties, hangers, refrigerant piping, water piping, hose kits/valves, insulation, isolation valves, watt-hour meters, tenant billing software, additional refrigerant, roof rails or curbs, condensing unit mounting brackets, humidity sensors, external vibration isolation, rigging/receiving, addressing, rotary dials, dipswitches, spare parts, service labor, installation labor, LEV installation, LEV sensor installation, extended warranty.

Ductless Warranty/Technical Installation Support

A. Site Review by Ductless Technical Specialist
   1. Pre-construction meeting with Trane Ductless Technical Specialist required to review site conditions, installation requirements, best practices, and pre-startup requirements.
   2. At least (1) jobsite review during installation with Trane Ductless Technical Specialist required.
   3. If it is found that the refrigerant pipe lengths on the submittal diagrams must be significantly modified to achieve installation in the field, the installing Contractor must provide updated estimated piping layout prior to installation of pipe.
   4. Installing Contractor must provide updated as-built piping layout required to complete the Diamond System Builder design file prior to start-up.
   5. **Owner-Training by Trane Service Department is not included unless otherwise noted.**

B. VRF City-Multi Start-Up Assistance by Ductless Technical Specialist
   1. **No start-up assistance included on Nv&P-Series Mini-Splits unless otherwise noted.**
   2. Trane can provide a Ductless Technical Specialist to supervise the start-up of up to 2 systems.
   3. Installing Contractor MUST have technicians on-site to perform mechanical start-up under the supervision of Trane. Technician must be equipped with Maintenance Tool and a Laptop.
   4. Installing Contractor must contact Ductless Technical Specialist to schedule VRF Assisted Start-Up no less than 2 weeks before requested start-up date.
   5. Installing contractor must submit completed Component Location Sheet and Prestart Checklist to Ductless Technical Specialist no later than 3-days prior to requested start-up date.
   6. Installing Contractor must verify system installations meet Trane-Mitsubishi requirements including but not limited to service clearances, pressure tests, vacuum tests, electrical power to units, wiring/piping connections, and refrigerant charge prior to start-up.
   7. No installation labor will be completed by Trane personnel unless otherwise noted.
   8. City Multi and Nv&P-Series Service/Maintenance Tools not included unless otherwise noted.
   9. Any additional labor required from Trane to complete start-up procedure will be billed separately.

   Responsibilities of DTS at Assisted Start-Up:
      1. Provide support to installing contractor as system start-up data is pulled into Maintenance Tool
      2. Population of TE-200/TW-50 if applicable (any integration and programming by others)

   Responsibilities of Installing Contractor at Assisted Start-Up:
      1. Electrical Testing on outdoor units
      2. Physical inspection of the outdoor units
      3. Troubleshoot indoor units if there is an issue
      4. Handling of additional refrigerant and adding of trim charge
      5. **Setting addresses, dipswitches, and rotary dials on the Indoor units, Outdoor units, Controllers, and Branch Controllers.**
      6. Performing of vacuum and pressure tests

C. Warranty

1. VRF City-Multi Standard Warranty is 1 year parts, 7 year compressor from the time of startup. VRF City-Multi Extended 10-Year Parts/Compressor Warranty will be applied if the following requirements are met:
    a. Installing Contractor completes a certified Trane-Mitsubishi 3-day City-Multi Installation/Service Course, and documents attendees and date of completion.
    b. The system is designed by a certified Diamond Designer using Diamond System Builder™
    c. The contractor generates a complete and approved METUS Extended Warranty Process Report from the Diamond System Builder software.

    (See Trane-Mitsubishi Warranty Policy for details.)
2. **Installing Contractor is responsible for completion of Diamond System Builder warranty filing and final submission to METUS Extended Warranty Department.**
3. Nv&P Series Standard Warranty is 5 year parts, 7 year compressor from the time of startup. Nv&P Series Extended 10-Year Parts/Compressor Warranty will be applied if the product is installed in a residential application and registered within 90 days of installation. See Nv-Series and P-Series Limited Warranty Policies for details.
4. No labor warranty is included here unless otherwise noted. Please contact your Trane Account Manager for availability.

Supplementary Guidelines

A. Purchasing Contractor and/or Consulting Engineer must validate unit voltages, model numbers, quantities, required accessories, and unit configurations prior to order.
B. Consulting Engineer/Architect and Installing Contractor must approve equipment submittals and system design prior to order, including but not limited to all code/standard compliances, system application (heat pump vs. heat recovery), service clearances, refrigerant concentration compliance, load analysis, unit configuration, and installation requirements.
C. Outdoor condensing units must be installed on stands at a minimum height of 12”. Ground installation or raised pads are not acceptable.
D. Insulation is required on all condensate piping and refrigerant piping including liquid lines, low pressure gas lines, and high pressure gas lines.
E. All M-Net Control Wiring must be 16AWG, 2-conductor, stranded, shielded cable (MA controllers allow 22-16AWG wire)
F. All BC-Controllers must have condensate drain line installed.
G. All Linear Expansion Valve kits require 208V/1ph power.
H. Additional units/accessories not included in the scope will be at an additional cost.
I. All TQ*YP Water Source units require a **field-supplied** flow switch and strainer. Water quality must be adequately maintained. See the METUS installation manual for full details.

Disclaimer:

To protect our climate and reduce emissions from hydrofluorocarbons (HFCs), the American Innovation & Manufacturing (AIM) Act directs the U.S. Environmental Protection Agency (EPA) to phase down the supply of HFCs. This proposal includes Mitsubishi Electric Trane HVAC Mini Split heat pump products that must comply with the AIM Act by transitioning to a next-generation refrigerants with less than 700 GWP, R-454B has a global warming potential of 466 and will replace the proposed R-410A mini split systems quoted on this project when R-410A unit inventory is depleted. The AIM act mandates that manufacturers must discontinue manufacturing R-410A mini split heat pumps by December 31st 2024 and discontinue selling them by December 31st 2025. As such, Trane will begin to phase down the sale and distribution of R-410A mini splits in the 2025 calendar year and transition to R-454B mini splits when R-410A unit inventory is depleted. The above proposal includes R-410A product that will be subject to this transition. This pricing is only valid for the items listed on the proposal and is only valid until R-410A unit inventory is depleted. At such time, this proposal will need to be updated to include R-454B units. Please contact your Trane field Sales Representative for an updated quote/budget.

TERMS AND CONDITIONS – COMMERCIAL INSTALLATION

"Company" shall mean Trane U.S. Inc. for Work performed in the United States or Trane Canada ULC for Work performed in Canada.

1. Acceptance; Agreement. These terms and conditions are an integral part of Company's offer and form the basis of any agreement (the "Agreement") resulting from Company's proposal (the "Proposal") for the commercial goods and/or services described (the "Work"). COMPANY'S TERMS AND CONDITIONS AND EQUIPMENT PRICES ARE SUBJECT TO PERIODIC CHANGE OR AMENDMENT. The Proposal is subject to acceptance in writing by the party to whom this offer is made or an authorized agent ("Customer") delivered to Company within 30 days from the date of the Proposal. Prices in the Proposal are subject to change at any time upon notice to Customer. If Customer accepts the Proposal by placing an order, without the addition of any other terms and conditions of sale or any other modification, Customer's order shall be deemed acceptance of the Proposal subject to Company's terms and conditions. If Customer's order is expressly conditioned upon Company's acceptance or assent to terms and/or conditions other than those expressed herein, return of such order by Company with Company's terms and conditions attached or referenced serves as Company's notice of objection to Customer's terms and as Company's counteroffer to provide Work in accordance with the Proposal and the Company terms and conditions. If Customer does not reject or object in writing to Company within 10 days, Company's counteroffer will be deemed accepted. Notwithstanding anything to the contrary herein, Customer's acceptance of the Work by Company will in any event constitute an acceptance by Customer of Company's terms and conditions. This Agreement is subject to credit approval by Company. Upon disapproval of credit, Company may delay or suspend performance or, at its option, renegotiate prices and/or terms and conditions with Customer. If Company and Customer are unable to agree on such revisions, this Agreement shall be cancelled without any liability, other than Customer's obligation to pay for Work rendered by Company to the date of cancellation.

2. Connected Services. In addition to these terms and conditions, the Connected Services Terms of Service ("Connected Services Terms"), available at https://www.trane.com/TraneConnectedServicesTerms, as updated from time to time, are incorporated herein by reference and shall apply to the extent that Company provides Customer with Connected Services, as defined in the Connected Services Terms.

3. Title and Risk of Loss. All Equipment sales with destinations to Canada or the U.S. shall be made as follows: FOB Company's U.S. manufacturing facility or warehouse (full freight allowed). Title and risk of loss or damage to Equipment will pass to Customer upon tender of delivery of such to carrier at Company's U.S. manufacturing facility or warehouse.

4. Pricing and Taxes. Unless otherwise noted, the price in the Proposal includes standard ground transportation and, if required by law, all sales, consumer, use and similar taxes legally enacted as of the date hereof for equipment and material installed by Company. Tax exemption is contingent upon Customer furnishing appropriate certificates evidencing Customer's tax-exempt status. Company shall charge Customer additional costs for bonds agreed to be provided. Equipment sold on an uninstalled basis and any taxable labor/labour do not include sales tax and taxes will be added. Within thirty (30) days following Customer acceptance of the Proposal without addition of any other terms and conditions of sale or any modification, Customer shall provide notification of release for immediate production at Company's factory. Prices for Work are subject to change at any time prior to shipment to reflect any cost increases related to the manufacture, supply, and shipping of goods. This includes, but is not limited to, cost increases in raw materials, supplier components, labor, utilities, freight, logistics, wages and benefits, regulatory compliance, or any other event beyond Company's control. If such release is not received within 6 months after date of order receipt, Company reserves the right to cancel any order. If shipment is delayed due to Customer's actions, Company may also charge Customer storage fees. Company shall be entitled to equitable adjustments in the contract price to reflect any cost increases as set forth above and will provide notice to Customer prior to the date for which the increased price is to be in effect for the applicable customer contract. In no event will prices be decreased.

5. Exclusions from Work. Company's obligation is limited to the Work as defined and does not include any modifications to the Work site under the Americans With Disabilities Act or any other law or building code(s). In no event shall Company be required to perform work Company reasonably believes is outside of the defined Work without a written change order signed by Customer and Company.

6. Performance. Company shall perform the Work in accordance with industry standards generally applicable in the area under similar circumstances as of the time Company performs the Work. Company may refuse to perform any Work where working conditions could endanger property or put at risk the safety of persons. Unless otherwise agreed to by Customer and Company, at Customer's expense and before the Work begins, Customer will provide any necessary access platforms, catwalks to safely perform the Work in compliance with OSHA or state industrial safety regulations.

7. Payment. Customer shall pay Company's invoices within net 30 days of invoice date. Company may invoice Customer for all equipment or material furnished, whether delivered to the installation site or to an off-site storage facility and for all Work performed on-site or off-site. No retention shall be withheld from any payments except as expressly agreed in writing by Company, in which case retention shall be reduced per the contract documents and released no later than the date of substantial completion. Under no circumstances shall any retention be withheld for the equipment portion of the order. If payment is not received as required, Company may suspend performance and the time for completion shall be extended for a reasonable period of time not less than the period of suspension. Customer shall be liable to Company for all reasonable shutdown, standby and start-up costs as a result of the suspension. Company reserves the right to add to any account outstanding for more than 30 days a service charge equal to 1.5% of the principal amount due at the end of each month. Customer shall pay all costs (including attorneys' fees) incurred by Company in attempting to collect amounts due and otherwise enforcing these terms and conditions. If requested, Company will provide appropriate lien waivers upon receipt of payment. Customer agrees that, unless Customer makes payment in advance, Company will have a purchase money security interest in all equipment from Company to secure payment in full of all amounts due Company and its order for the equipment, together with these terms and conditions, form a security agreement. Customer shall keep the equipment free of all taxes and encumbrances, shall not remove the equipment from its original installation point and shall not assign or transfer any interest in the equipment until all payments due Company have been made.

8. Time for Completion. Except to the extent otherwise expressly agreed in writing signed by an authorized representative of Company, all dates provided by Company or its representatives for commencement, progress or completion are estimates only. While Company shall use commercially reasonable efforts to meet such estimated dates, Company shall not be responsible for any damages for its failure to do so. Delivery dates are approximate and not guaranteed. Company will use commercially reasonable efforts to deliver the Equipment on or before the estimated delivery date, will notify Customer if the estimated delivery dates cannot be honored, and will deliver the Equipment and services as soon as practicable thereafter. In no event will Company be liable for any damages or expenses caused by delays in delivery.

9. Access. Company and its subcontractors shall be provided access to the Work site during regular business hours, or such other hours as may be requested by Company and acceptable to the Work site' owner or tenant for the performance of the Work, including sufficient areas for staging, mobilization, and storage. Company's access to correct any emergency condition shall not be restricted. Customer grants to Company the right to remotely connect (via phone modem, internet or other agreed upon means) to Customer's building automation system (BAS) and or HVAC equipment to view, extract, or otherwise collect and retain data from the BAS, HVAC equipment, or other building systems, and to diagnose and remotely make repairs at Customer's request.

10. Completion. Notwithstanding any other term or condition herein, when Company informs Customer that the Work has been completed, Customer shall inspect the Work in the presence of Company's representative, and Customer shall either (a) accept the Work in its entirety in writing, or (b) accept the Work in part and specifically identify, in writing, any exception items. Customer agrees to re-inspect any and all excepted items as soon as Company informs Customer that all such excepted items have been completed. The initial acceptance inspection shall take place within ten (10) days from the date when Company informs Customer that the Work has been completed. Any subsequent re-inspection of excepted items shall take place within five (5) days from the date when Company informs Customer that the excepted items have been completed. Customer's failure to cooperate and complete any of said inspections within the required time limits shall constitute complete acceptance of the Work as of ten (10) days from date when Company informs Customer that the Work, or the excepted items, if applicable, has/have been completed.

11. Permits and Governmental Fees. Company shall secure (with Customer's assistance) and pay for building and other permits and governmental fees, licenses, and inspections necessary for proper performance and completion of the Work which are legally required when bids from Company's subcontractors are received, negotiations thereon concluded, or the effective date of a relevant Change Order, whichever is later. Customer is responsible for necessary approvals, easements, assessments and charges for construction, use or occupancy of permanent structures or for permanent changes to existing facilities. If the cost of such permits, fees, licenses and inspections are not included in the Proposal, Company will invoice Customer for such costs.

12. Utilities During Construction. Customer shall provide without charge to Company all water, heat, and utilities required for performance of the Work.

13. Concealed or Unknown Conditions. In the performance of the Work, if Company encounters conditions at the Work site that are (i) subsurface or otherwise concealed physical conditions that differ materially from those indicated on drawings expressly incorporated herein or (ii) unknown physical conditions of an unusual nature that differ materially from those conditions ordinarily found to exist and generally recognized as inherent in construction activities of the type and character as the Work, Company shall notify Customer of such conditions promptly, prior to significantly disturbing same. If such conditions differ materially and cause an increase in Company's cost of, or time required for, performance of any part of the Work, Company shall be entitled to, and Customer shall consent by Change Order to, an equitable adjustment in the Contract Price, contract time, or both.

14. Pre-Existing Conditions. Company is not liable for any claims, damages, losses, or expenses, arising from or related to conditions that existed in, on, or upon the Work site before the Commencement Date of this Agreement ("Pre-Existing Conditions"), including, without limitation, damages, losses, or expenses involving Pre-Existing Conditions of building envelope issues, mechanical issues, plumbing issues, and/or indoor air quality issues involving mold/mould and/or fungi. Company also is not liable for any claims, damages, losses, or expenses, arising from or related to work done by or services provided by individuals or entities that are not employed by or hired by Company.

15. Asbestos and Hazardous Materials. Company's Work and other services in connection with this Agreement expressly excludes any identification, abatement, cleanup, control, disposal, removal or other work connected with asbestos, polychlorinated biphenyl ("PCB"), or other hazardous materials (hereinafter, collectively, "Hazardous Materials"). Customer warrants and represents that, except as set forth in a writing signed by Company, there are no Hazardous Materials on the Work site

that will in any way affect Company's Work and Customer has disclosed to Company the existence and location of any Hazardous Materials in all areas within which Company will be performing the Work. Should Company become aware of or suspect the presence of Hazardous Materials, Company may immediately stop work in the affected area and shall notify Customer. Customer will be exclusively responsible for taking any and all action necessary to correct the condition in accordance with all applicable laws and regulations. Customer shall be exclusively responsible for and, to the fullest extent permitted by law, shall indemnify and hold harmless Company (including its employees, agents and subcontractors) from and against any loss, claim, liability, fees, penalties, injury (including death) or liability of any nature, and the payment thereof arising out of or relating to any Hazardous Materials on or about the Work site, not brought onto the Work site by Company. Company shall be required to resume performance of the Work in the affected area only in the absence of Hazardous Materials or when the affected area has been rendered harmless. In no event shall Company be obligated to transport or handle Hazardous Materials, provide any notices to any governmental agency, or examine the Work site for the presence of Hazardous Materials.

16. Force Majeure. Company's duty to perform under this Agreement is contingent upon the non-occurrence of an Event of Force Majeure. If Company shall be unable to carry out any material obligation under this Agreement due to an Event of Force Majeure, this Agreement shall at Company's election (i) remain in effect but Company's obligations shall be suspended until the uncontrollable event terminates or (ii) be terminated upon 10 days' notice to Customer, in which event Customer shall pay Company for all parts of the Work furnished to the date of termination. An "Event of Force Majeure" shall mean any cause or event beyond the control of Company. Without limiting the foregoing, "Event of Force Majeure" includes: acts of God; acts of terrorism, war or the public enemy; flood; earthquake; tornado; storm; fire; civil disobedience; pandemic insurrections; riots; labor/labour disputes; labor/labour or material shortages; sabotage; restraint by court order or public authority (whether valid or invalid), and action or non-action by or inability to obtain or keep in force the necessary governmental authorizations, permits, licenses, certificates or approvals if not caused by Company; and the requirements of any applicable government in any manner that diverts either the material or the finished product to the direct or indirect benefit of the government.

17. Customer's Breach. Each of the following events or conditions shall constitute a breach by Customer and shall give Company the right, without an election of remedies, to terminate this Agreement or suspend performance by delivery of written notice: (1) Any failure by Customer to pay amounts when due; or (2) any general assignment by Customer for the benefit of its creditors, or if Customer becomes bankrupt or insolvent or takes the benefit of any statute for bankrupt or insolvent debtors, or makes or proposes to make any proposal or arrangement with creditors, or if any steps are taken for the winding up or other termination of Customer or the liquidation of its assets, or if a trustee, receiver, or similar person is appointed over any of the assets or interests of Customer; (3) Any representation or warranty furnished by Customer in this Agreement is false or misleading in any material respect when made; or (4) Any failure by Customer to perform or comply with any material provision of this Agreement. Customer shall be liable to Company for all Work furnished to date and all damages sustained by Company (including lost profit and overhead)

18. Indemnity. To the fullest extent permitted by law, Company and Customer shall indemnify, defend and hold harmless each other from any and all claims, actions, costs, expenses, damages and liabilities, including reasonable attorneys' fees, resulting from death or bodily injury or damage to real or tangible personal property, to the extent caused by the negligence or misconduct of their respective employees or other authorized agents in connection with their activities within the scope of this Agreement. Neither party shall indemnify the other against claims, damages, expenses or liabilities to the extent attributable to the acts or omissions of the other party. If the parties are both at fault, the obligation to indemnify shall be proportional to their relative fault. The duty to indemnify will continue in full force and effect, notwithstanding the expiration or early termination hereof, with respect to any claims based on facts or conditions that occurred prior to expiration or termination.

19. Limitation of Liability. NOTWITHSTANDING ANYTHING TO THE CONTRARY, IN NO EVENT SHALL COMPANY BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT CONSEQUENTIAL, OR PUNITIVE OR EXEMPLARY DAMAGES (INCLUDING WITHOUT LIMITATION BUSINESS INTERRUPTION, LOST DATA, LOST REVENUE, LOST PROFITS, LOST DOLLAR SAVINGS, OR LOST ENERGY USE SAVINGS, INCLUDING CONTAMINANTS LIABILITIES, EVEN IF A PARTY HAS BEEN ADVISED OF SUCH POSSIBLE DAMAGES OR IF SAME WERE REASONABLY FORESEEABLE AND REGARDLESS OF WHETHER THE CAUSE OF ACTION IS FRAMED IN CONTRACT, NEGLIGENCE, ANY OTHER TORT, WARRANTY, STRICT LIABILITY, OR PRODUCT LIABILITY). In no event will Company's liability in connection with the provision of products or services or otherwise under this Agreement exceed the entire amount paid to Company by Customer under this Agreement.

20. CONTAMINANTS LIABILITY

The transmission of COVID-19 may occur in a variety of ways and circumstances, many of the aspects of which are currently not known. HVAC systems, products, services and other offerings have not been tested for their effectiveness in reducing the spread of COVID-19, including through the air in closed environments. **IN NO EVENT WILL COMPANY BE LIABLE UNDER THIS AGREEMENT OR OTHERWISE FOR ANY INDEMNIFICATION, ACTION OR CLAIM, WHETHER BASED ON WARRANTY, CONTRACT, TORT OR OTHERWISE, FOR ANY BODILY INJURY (INCLUDING DEATH), DAMAGE TO PROPERTY, OR ANY OTHER LIABILITIES, DAMAGES OR COSTS RELATED TO CONTAMINANTS (INCLUCING THE SPREAD, TRANSMISSION, MITIGATION, ELIMINATION, OR CONTAMINATION THEREOF) (COLLECTIVELY, "CONTAMINANT LIABILITIES") AND CUSTOMER HEREBY EXPRESSLY RELEASES COMPANY FROM ANY SUCH CONTAMINANTS LIABILITIES.**

21. Patent Indemnity. Company shall protect and indemnify Customer from and against all claims, damages, judgments and loss arising from infringement or alleged infringement of any United States patent by any of the goods manufactured by Company and delivered hereunder, provided that in the event of suit or threat of suit for patent infringement, Company shall promptly be notified and given full opportunity to negotiate a settlement. Company does not warrant against infringement by reason of Customer's design of the articles or the use thereof in combination with other materials or in the operation of any process. In the event of litigation, Customer agrees to reasonably cooperate with Company. In connection with any proceeding under the provisions of this Section, all parties concerned shall be entitled to be represented by counsel at their own expense.

22. Limited Warranty. Company warrants for a period of 12 months from the date of substantial completion ("Warranty Period") commercial equipment manufactured and installed by Company against failure due to defects in material and manufacture and that the labor/labour furnished is warranted to have been properly performed (the "Limited Warranty"). Trane equipment sold on an uninstalled basis is warranted in accordance with Company's standard warranty for supplied equipment. **Product manufactured by Company that includes required startup and is sold in North America will not be warranted by Company unless Company performs the product start-up**. Substantial completion shall be the earlier of the date that the Work is sufficiently complete so that the Work can be utilized for its intended use or the date that Customer receives beneficial use of the Work. If such defect is discovered within the Warranty Period, Company will correct the defect or furnish replacement equipment (or, at its option, parts therefor) and, if said equipment was installed pursuant hereto, labor/labour associated with the replacement of parts or equipment not conforming to this Limited Warranty. Defects must be reported to Company within the Warranty Period. Exclusions from this Limited Warranty include damage or failure arising from: wear and tear; corrosion, erosion, deterioration; Customer's failure to follow the Company-provided maintenance plan; refrigerant not supplied by Company; and modifications made by others to Company's equipment. Company shall not be obligated to pay for the cost of lost refrigerant. Notwithstanding the foregoing, all warranties provided herein terminate upon termination or cancellation of this Agreement. No warranty liability whatsoever shall attach to Company until the Work has been paid for in full and then said liability shall be limited to the lesser of Company's cost to correct the defective Work and/or the purchase price of the equipment shown to be defective. Equipment, material and/or parts that are not manufactured by Company ("Third-Party Product(s)" are not warranted by Company and have such warranties as may be extended by the respective manufacturer. **CUSTOMER UNDERSTANDS THAT COMPANY IS NOT THE MANUFACTURER OF ANY THIRD-PARTY PRODUCT(S) AND ANY WARRANTIES, CLAIMS, STATEMENTS, REPRESENTATIONS, OR SPECIFICATIONS ARE THOSE OF THE THIRD-PARTY MANUFACTURER, NOT COMPANY AND CUSTOMER IS NOT RELYING ON ANY WARRANTIES, CLAIMS, STATEMENTS, REPRESENTATIONS, OR SPECIFICATIONS REGARDING THE THIRD-PARTY PRODUCT THAT MAY BE PROVIDED BY COMPANY OR ITS AFFILIATES, WHETHER ORAL OR WRITTEN. THE WARRANTY AND LIABILITY SET FORTH IN THIS AGREEMENT ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESS OR IMPLIED, IN LAW OR IN FACT, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND/OR OTHERS ARISING FROM COURSE OF DEALING OR TRADE. COMPANY MAKES NO REPRESENTATION OR WARRANTY .OF ANY KIND, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. ADDITIONALLY, COMPANY MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND REGARDING PREVENTING, ELIMINATING, REDUCING OR INHIBITING ANY MOLD, FUNGUS, BACTERIA, VIRUS, MICROBIAL GROWTH, OR ANY OTHER CONTAMINANTS (INCLUDING COVID-19 OR ANY SIMILAR VIRUS) (COLLECTIVELY, "CONTAMINANTS"), WHETHER INVOLVING OR IN CONNECTION WITH EQUIPMENT, ANY COMPONENT THEREOF, SERVICES OR OTHERWISE. IN NO EVENT SHALL COMPANY HAVE ANY LIABILITY FOR THE PREVENTION, ELIMINATION, REDUCTION OR INHIBITION OF THE GROWTH OR SPREAD OF SUCH CONTAMINANTS INVOLVING OR IN CONNECTION WITH ANY EQUIPMENT, THIRD-PARTY PRODUCT, OR ANY COMPONENT THEREOF, SERVICES OR OTHERWISE AND CUSTOMER HEREBY SPECIFICALLY ACKNOWLDGES AND AGREES THERETO.**

23. Insurance. Company agrees to maintain the following insurance while the Work is being performed with limits not less than shown below and will, upon request from Customer, provide a Certificate of evidencing the following coverage:

Commercial General Liability	$2,000,000 per occurrence
Automobile Liability	$2,000,000 CSL
Workers Compensation	Statutory Limits

If Customer has requested to be named as an additional insured under Company's insurance policy, Company will do so but only subject to Company's manuscript additional insured endorsement under its primary Commercial General Liability policies. In no event does Company waive its right of subrogation.

24. Commencement of Statutory Limitation Period. Except as to warranty claims, as may be applicable, any applicable statutes of limitation for acts or failures to act shall commence to run, and any alleged cause of action stemming therefrom shall be deemed to have accrued, in any and all events not later than the last date that Company or its subcontractors physically performed work on the project site.

25. General. Except as provided below, to the maximum extent provided by law, this Agreement is made and shall be interpreted and enforced in accordance with the laws of the state or province in which the Work is performed, without regard to choice of law principles which might otherwise call for the application of a different state's or province's law. Any dispute arising under or relating to this Agreement that is not disposed of by agreement shall be decided by litigation in a court of competent jurisdiction located in the state or province in which the Work is performed. To the extent the Work site is owned and/or operated by any agency of the Federal Government, determination of any substantive issue of law shall be according to the Federal common law of Government contracts as enunciated and applied by Federal judicial bodies and boards of contract appeals of the Federal Government. This Agreement contains all of the agreements, representations and understandings of the parties and supersedes all previous understandings, commitments or agreements, oral or written, related to the subject matter hereof. This Agreement may not be amended, modified or terminated except by a writing signed by the parties hereto. No documents shall be incorporated herein by reference except to the extent Company is a signatory thereon. If any term or condition of this Agreement is invalid, illegal or incapable of being enforced by any rule of law, all other terms and conditions of this Agreement will nevertheless remain in full force and effect as long as the economic or legal substance of the transaction contemplated hereby is not affected in a manner adverse to any party hereto. Customer may not assign, transfer, or convey this Agreement, or any part hereof, or its right, title or interest herein, without the written consent of the Company. Subject to the foregoing, this Agreement shall be binding upon and inure to the benefit of Customer's permitted successors and assigns. This Agreement may be executed in several counterparts, each of which when executed shall be deemed to be an original, but all together shall constitute but one and the same Agreement. A fully executed facsimile copy hereof or the several counterparts shall suffice as an original.

26. Equal Employment Opportunity/Affirmative Action Clause. Company is a federal contractor that complies fully with Executive Order 11246, as amended, and the applicable regulations contained in 41 C.F.R. Parts 60-1 through 60-60, 29 U.S.C. Section 793 and the applicable regulations contained in 41 C.F.R. Part 60-741; and 38 U.S.C. Section 4212 and the applicable regulations contained in 41 C.F.R. Part 60-250 Executive Order 13496 and Section 29 CFR 471, appendix A to subpart A, regarding the notice of employee rights in the United States and with Canadian Charter of Rights and Freedoms Schedule B to the Canada Act 1982 (U.K.) 1982, c. 11 and applicable Provincial Human Rights Codes and employment law in Canada.

27. U.S. Government Work.

The following provision applies only to direct sales by Company to the US Government. The Parties acknowledge that all items or services ordered and delivered under this Agreement are Commercial Items as defined under Part 12 of the Federal Acquisition Regulation (FAR). In particular, Company agrees to be bound only by those Federal contracting clauses that apply to "commercial" suppliers and that are contained in FAR 52.212-5(e)(1). Company complies with 52.219-8 or 52.219-9 in its service and installation contracting business.

The following provision applies only to indirect sales by Company to the US Government. As a Commercial Item Subcontractor, Company accepts only the following mandatory flow down provisions in effect as of the date of this subcontract: 52.203-19; 52.204-21; 52.204-23; 52.219-8; 52.222-21; 52.222-26; 52.222-35; 52.222-36; 52.222-50; 52.225-26; 52.247-64. If the Work is in connection with a U.S. Government contract, Customer certifies that it has provided and will provide current, accurate, and complete information, representations and certifications to all government officials, including but not limited to the contracting officer and officials of the Small Business Administration, on all matters related to the prime contract, including but not limited to all aspects of its ownership, eligibility, and performance. Anything herein notwithstanding, Company will have no obligations to Customer unless and until Customer provides Company with a true, correct and complete executed copy of the prime contract. Upon request, Customer will provide copies to Company of all requested written communications with any government official related to the prime contract prior to or concurrent with the execution thereof, including but not limited to any communications related to Customer's ownership, eligibility or performance of the prime contract. Customer will obtain written authorization and approval from Company prior to providing any government official any information about Company's performance of the work that is the subject of the Proposal or this Agreement, other than the Proposal or this Agreement.

28. Limited Waiver of Sovereign Immunity. If Customer is an Indian tribe (in the U.S.) or a First Nation or Band Council (in Canada), Customer, whether acting in its capacity as a government, governmental entity, a duly organized corporate entity or otherwise, for itself and for its agents, successors, and assigns: (1) hereby provides this limited waiver of its sovereign immunity as to any damages, claims, lawsuit, or cause of action (herein "Action") brought against Customer by Company and arising or alleged to arise out of the furnishing by Company of any product or service under this Agreement, whether such Action is based in contract, tort, strict liability, civil liability or any other legal theory; (2) agrees that jurisdiction and venue for any such Action shall be proper and valid (a) if Customer is in the U.S., in any state or United States court located in the state in which Company is performing this Agreement or (b) if Customer is in Canada, in the superior court of the province or territory in which the work was performed; (3) expressly consents to such Action, and waives any objection to jurisdiction or venue; (4) waives any requirement of exhaustion of tribal court or administrative remedies for any Action arising out of or related to this Agreement; and (5) expressly acknowledges and agrees that Company is not subject to the jurisdiction of Customer's tribal court or any similar tribal forum, that Customer will not bring any action against Company in tribal court, and that Customer will not avail itself of any ruling or direction of the tribal court permitting or directing it to suspend its payment or other obligations under this Agreement. The individual signing on behalf of Customer warrants and represents that such individual is duly authorized to provide this waiver and enter into this Agreement and that this Agreement constitutes the valid and legally binding obligation of Customer, enforceable in accordance with its terms.

29. Building Automation Systems and Network Security. Customer and Trane acknowledge that Building Automation System (BAS) and connected networks security requires Customer and Trane to maintain certain cybersecurity obligations. Customer acknowledges that upon completion of installation and configuration of the BAS, the Customer maintains ownership of the BAS and the connected network equipment. Except for any applicable warranty obligations, Customer is solely responsible for the maintenance and security of the BAS and related networks and systems. In the event there is a service agreement between Trane and Customer, Trane will provide the services as set forth in the service agreement.

In order to maintain a minimum level of security for the BAS, associated networks, network equipment and systems, Customer's cybersecurity responsibilities include without limitation:

1. Ensure that the BAS, networks, and network equipment are physically secure and not accessible to unauthorized personnel.
2. Ensure the BAS remains behind a secure firewall and properly segmented from all other customer networks and systems, especially those with sensitive information.
3. Keep all Inbound ports closed to any IP Addresses in the BAS.
4. Remove all forwarded inbound ports and IP Addresses to the BAS.
5. Maintain user login credentials and unique passwords, including the use of strong passwords and the removal of access for users who no longer require access.
6. Where remote access is desired, utilize a secure method such as Trane Connect Secure Remote Access or your own VPN.
7. For any Trane services requiring remote data transfer and/or remote user access, configure the BAS and related firewall(s) per instructions provided by Trane. This typically includes configuring Port 443 and associated firewall(s) for Outbound only.
8. Perform regular system maintenance to ensure that your BAS is properly secured, including regular software updates to your BAS and related network equipment (i.e., firewalls).

Any and all claims, actions, losses, expenses, costs, damages, or liabilities of any nature due to Customer's failure to maintain BAS security responsibilities and/or industry standards for cybersecurity are the sole responsibility of the Customer.

1-26.251-10(1024)
Supersedes 1-26.251-10(0123)

SECURITY ADDENDUM

This Addendum shall be applicable to the sale, installation and use of Trane equipment and the sale and provision of Trane services. "Trane" shall mean Trane U.S. Inc. for sales and services in the United States, or Trane Canada ULC for sales and services in Canada.

1. **Definitions.** All terms used in this Addendum shall have the meaning specified in the Agreement unless otherwise defined herein. For the purposes of this Addendum, the following terms are defined as follows:

   "Customer Data" means Customer account information as related to the Services only and does not include HVAC Machine Data or personal data. Trane does not require, nor shall Customer provide personal data to Trane under the Agreement. Such data is not required for Trane to provide its Equipment and/or Services to the Customer.

   "Equipment" shall have the meaning set forth in the Agreement.

   "HVAC Machine Data" means data generated and collected from the product or furnished service without manual entry. HVAC Machine Data is data relating to the physical measurements and operating conditions of a HVAC system, such as but not limited to, temperatures, humidity, pressure, HVAC equipment status. HVAC Machine Data does not include Personal Data and, for the purposes of this agreement, the names of users of Trane's controls products or hosted applications shall not be Personal Data, if any such user chooses to use his/her name(s) in the created accounts within the controls product (e.g., firstname.lastname@address.com). HVAC Machine Data may be used by Trane: (a) to provide better support services and/or products to users of its products and services; (b) to assess compliance with Trane terms and conditions; (c) for statistical or other analysis of the collective characteristics and behaviors of product and services users; (d) to backup user and other data or information and/or provide remote support and/or restoration; (e) to provide or undertake: engineering analysis; failure analysis; warranty analysis; energy analysis; predictive analysis; service analysis; product usage analysis; and/or other desirable analysis, including, but not limited to, histories or trends of any of the foregoing; and (f) to otherwise understand and respond to the needs of users of the product or furnished service. "Personal Data" means data and/or information that is owned or controlled by Customer, and that names or identifies, or is about a natural person, such as: (i) data that is explicitly defined as a regulated category of data under any data privacy laws applicable to Customer; (ii) non-public personal information ("NPI") or personal information ("PI"), such as national identification number, passport number, social security number, social insurance number, or driver's license number; (iii) health or medical information, such as insurance information, medical prognosis, diagnosis information, or genetic information; (iv) financial information, such as a policy number, credit card number, and/or bank account number; (v) personally identifying technical information (whether transmitted or stored in cookies, devices, or otherwise), such as IP address, MAC address, device identifier, International Mobile Equipment Identifier ("IMEI"), or advertising identifier; (vi) biometric information; and/or (vii) sensitive personal data, such as, race, religion, marital status, disability, gender, sexual orientation, geolocation, or mother's maiden name.

   "Security Incident" shall refer to (i) a compromise of any network, system, application or data in which Customer Data has been accessed or acquired by an unauthorized third party; (ii) any situation where Trane reasonably suspects that such compromise may have occurred; or (iii) any actual or reasonably suspected unauthorized or illegal Processing, loss, use, disclosure or acquisition of or access to any Customer Data.

   "Services" shall have the meaning set forth in the Agreement.

2. HVAC Machine Data; Access to Customer Extranet and Third Party Systems. If Customer grants Trane access to HVAC Machine Data via web portals or other non-public websites or extranet services on Customer's or a third party's website or system (each, an "Extranet"), Trane will comply with the following:
   a. Accounts. Trane will ensure that Trane's personnel use only the Extranet account(s) designated by Customer and will require Trane personnel to keep their access credentials confidential.
   b. Systems. Trane will access the Extranet only through computing or processing systems or applications running operating systems managed by Trane that include: (i) system network firewalls; (ii) centralized patch management; (iii) operating system appropriate anti-malware software; and (iv) for portable devices, full disk encryption.
   c. Restrictions. Unless otherwise approved by Customer in writing, Trane will not download, mirror or permanently store any HVAC Machine Data from any Extranet on any medium, including any machines, devices or servers.
   d. Account Termination. Trane will terminate the account of each of Trane's personnel in accordance with Trane's standard practices after any specific Trane personnel who has been authorized to access any Extranet (1) no longer needs access to HVAC Machine Data or (2) no longer qualifies as Trane personnel (e.g., the individual leaves Trane's employment).
   e. Third Party Systems. Trane will provide Customer prior notice before it uses any third party system that stores or may otherwise have access to HVAC Machine Data, unless (1) the data is encrypted and (2) the third party system will not have access to the decryption key or unencrypted "plain text" versions of the HVAC Machine Data.

3. Customer Data; Confidentiality. Trane shall keep confidential, and shall not access or use any Customer Data and information that is marked confidential or by its nature is considered confidential ("Customer Confidential Information") other than for the purpose of providing the Equipment and Services, and will disclose Customer Confidential Information only: (i) to Trane's

employees and agents who have a need to know to perform the Services, (ii) as expressly permitted or instructed by Customer, or (iii) to the minimum extent required to comply with applicable law, provided that Trane (1) provides Customer with prompt written notice prior to any such disclosure, and (2) reasonably cooperate with Customer to limit or prevent such disclosure.

4. Customer Data; Compliance with Laws. Trane agrees to comply with laws, regulations governmental requirements and industry standards and practices relating to Trane's processing of Customer Confidential Information (collectively, "***Laws***").

5. Customer Data; Information Security Management. Trane agrees to establish and maintain an information security and privacy program, consistent with applicable HVAC equipment industry practices that complies with this Addendum and applicable Laws ("***Information Security Program***"). The Information Security Program shall include appropriate physical, technical and administrative safeguards, including any safeguards and controls agreed by the Parties in writing, sufficient to protect Customer systems, and Customer's Confidential Information from unauthorized access, destruction, use, modification or disclosure. The Information Security Program shall include appropriate, ongoing training and awareness programs designed to ensure that Trane's employees and agents, and others acting on Trane's, behalf are aware of and comply with the Information Security Program's policies, procedures, and protocols.

6. Monitoring. Trane shall monitor and, at regular intervals consistent with HVAC equipment industry practices, test and evaluate the effectiveness of its Information Security Program. Trane shall evaluate and promptly adjust its Information Security Program in light of the results of the testing and monitoring, any material changes to its operations or business arrangements, or any other facts or circumstances that Trane knows or reasonably should know may have a material impact on the security of Customer Confidential Information, Customer systems and Customer property.

7. Audits. Customer acknowledges and agrees that the Trane SOC2 audit report will be used to satisfy any and all audit/inspection requests/requirements by or on behalf of Customer. Trane will make its SOC2 audit report available to Customer upon request and with a signed nondisclosure agreement.

8. Information Security Contact. Trane's information security contact is Local Sales Office.

9. Security Incident Management. Trane shall notify Customer after the confirmation of a Security Incident that affects Customer Confidential Information, Customer systems and Customer property. The written notice shall summarize the nature and scope of the Security Incident and the corrective action already taken or planned.

10. Threat and Vulnerability Management. Trane regularly performs vulnerability scans and addresses detected vulnerabilities on a risk basis. Periodically, Trane engages third-parties to perform network vulnerability assessments and penetration testing. Vulnerabilities will be reported in accordance with Trane's cybersecurity vulnerability reported process. Trane periodically provides security updates and software upgrades.

11. Security Training and Awareness. New employees are required to complete security training as part of the new hire process and receive annual and targeted training (as needed and appropriate to their role) thereafter to help maintain compliance with Security Policies, as well as other corporate policies, such as the Trane Code of Conduct. This includes requiring Trane employees to annually re-acknowledge the Code of Conduct and other Trane policies as appropriate. Trane conducts periodic security awareness campaigns to educate personnel about their responsibilities and provide guidance to create and maintain a secure workplace.

12. Secure Disposal Policies. Trane will maintain policies, processes, and procedures regarding the disposal of tangible and intangible property containing Customer Confidential Information so that wherever possible, Customer Confidential Information cannot be practicably read or reconstructed.

13. Logical Access Controls. Trane employs internal monitoring and logging technology to help detect and prevent unauthorized access attempts to Trane's corporate networks and production systems. Trane's monitoring includes a review of changes affecting systems' handling authentication, authorization, and auditing, and privileged access to Trane production systems. Trane uses the principle of "least privilege" (meaning access denied unless specifically granted) for access to customer data.

14. Contingency Planning/Disaster Recovery. Trane will implement policies and procedures required to respond to an emergency or other occurrence (i.e. fire, vandalism, system failure, natural disaster) that could damage Customer Data or any system that contains Customer Data. Procedures include the following
    (i) Data backups; and
    (ii) Formal disaster recovery plan. Such disaster recovery plan is tested at least annually.

15. Return of Customer Data. If Trane is responsible for storing or receiving Customer Data, Trane shall, at Customer's sole discretion, deliver Customer Data to Customer in its preferred format within a commercially reasonable period of time following the expiration or earlier termination of the Agreement or, such earlier time as Customer requests, securely destroy or render unreadable or undecipherable each and every original and copy in every media of all Customer's Data in Trane's possession, custody or control no later than [90 days] after receipt of Customer's written instructions directing Trane to delete the Customer Data.

16. Background Checks Trane shall take reasonable steps to ensure the reliability of its employees or other personnel having access to the Customer Data, including the conducting of appropriate background and/or verification checks in accordance with Trane policies.

17. DISCLAIMER OF WARRANTIES. EXCEPT FOR ANY APPLICABLE WARRANTIES IN THE AGREEMENT, THE SERVICES ARE PROVIDED "AS IS", WITH ALL FAULTS, AND THE ENTIRE RISK AS TO SATISFACTORY QUALITY, PERFORMANCE, ACCURACY AND EFFORT AS TO SUCH SERVICES SHALL BE WITH CUSTOMER. TRANE DISCLAIMS ANY AND ALL OTHER EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES WITH RESPECT TO THE SERVICES AND THE SERVICES PROVIDED HEREUNDER, INCLUDING ANY EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR THAT THE SERVICES WILL OPERATE ERROR-FREE OR UNINTERRUPTED OR RETURN/RESPONSE TO INQUIRIES WITHIN ANY SPECIFIC PERIOD OF TIME.

October 2024
Supersedes: November 2023v2

Trane Omnia Equipment and Controls Scope
Thiells Elementary School

Proposal Prepared For:
North Rockland Central School District
65 Chapel St
Garnerville, NY 10923

Local Trane Office:
Trane U.S. Inc.
19 Chapin Road, Bldg B, Suite 200
Pine Brook, NJ 07058

Omnia Contract Number:
B6-uZ0AAK-24-010

Date: February 24, 2025

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Prepared For: North Rockland CSD

Date: February 24, 2025

Job Name:
North Rockland CSD Thiells ES Univent Replacement

Proposal Number: B6-256535-37249-1
OMNIA-COOP: RACINE COUNTY#3341
Opportunity ID: 7965355

Delivery Terms:
Freight Allowed and Prepaid - F.O.B. Jobsite

Engineer: Greenman Pedersen Incorporated

Payment Terms: Net 30 Days

Trane U.S. Inc. is pleased to provide the following proposal for your review and approval.

This Scope of Work will be executed based on Trane's scope of work proposed herein, which is a clarification of the plans and specifications, and adheres to Trane's "Standard Contract Terms and Conditions" only; any other document and/or contract will not bind and/or supersede these conditions.

Building Automation System

This proposal has been developed from the following documentation:

- Plans and Specs prepared by: Greenman Pedersen, Inc
- Mechanical drawings TES-M-003 through TES-M-303 dated 05/10/24
- Electrical drawings TES-E-061 through TES-501 dated 05/10/24
- Specification sections 230923, 230924 & 230993
- Additional drawings reviewed: No additional documents provided to Trane at the time of this bid. All additional work as a result of these documents that is not listed below is not included from this bid.

Trane's pricing accounts for the following considerations:

- **Straight Time Labor**
- Trane's Electrical field installation will be performed by: **Union Electrical Contractor**
- Electrical Installation: Refer to Electrical Clarification section below
- **1 Year** parts and labor warranty against defects in material and workmanship on all new, Trane provided, field installed, DDC controllers and components.
- **24 Hours of Controls Technician Assistance for integration with the Siemens Building Management System.**
- **24 Hours of Commissioning Assistance of 3rd Party Commissioning Agent.**
- Project to be completed by **August 30, 2025**; escalation costs incurred after this date are not included and will be in addition to the Total Net Price(s) stated below. Added costs will depend upon the remaining scope identified at that time.

The following is Trane's scope of work:

1) TRANE BACNET GATEWAY EQUIPMENT:

a) **Trane will provide a BACnet gateway for integration into the existing Siemens Enterprise Level Building Management System. Siemens will be able to communicate with this system via BACnet/IP. <u>Siemens will need to provide pricing to the district to integrate the new Trane system.</u>**

b) Trane to setup operator interface for proper interaction with the BAS. User workstation interface will be:
   i) **Owner furnished or provided by Siemens**

c) **Graphics to be provided by Siemens.**

2) ASSOCIATED MECHANICAL EQUIPMENT:

a) **VRF System.** BAS will provide monitoring, control, and alarming of available points.
   i. Includes field installation of the following devices:
      a. CAT-6 Wiring to Centralized Controller. Trane will provide integration to the VRF Centralized Controller via BACnet/IP.
      b. Interlock to **(9)** Outdoor Air-Cooled Condensing Unit(s)

   ii. Low Voltage Daisy Chain Communication Wiring (16Ga TSP) to the following components:
      a. **(26)** Indoor Units
      b. **(9)** Branch Controllers
      c. **(51)** LEV Controllers

   iii. Wiring to the following components associated with **each** Indoor Unit:
      a. **(26 total)** Space Thermostat [Furnished by manuf.]
      b. **(24 total)** Condensate Pump [High Limit Switch Wiring Only]
      c. **(24 total)** DPLS2 Leak Detector [Furnished by manuf.]
      d. **(6 total)** Inline Booster Fans to associated indoor unit
         a. Requires installation of Relay Module
         b. Fresh air damper interlock

b) (51) Unit Ventilators (UV-X) with factory mounted DDC controllers. BAS will provide monitoring, control, and alarming of available points and field installation of the following devices:
   i. Room temperature sensor [wireless]
   ii. Return air temperature sensor
   iii. Outside air temperature sensor
   iv. Hot water control valve
   v. (1 per UV) LEV Controller with **115V:208V** Step UP Transformer
   vi. **(1 per UV)** LEVs Valves (On DX Coil)
   vii. **(4 per UV)** VRF sensors per LEV Control Box. Each sensor shall be wired back to the LEV Control Box.This includes:
      1) **(2 per UV)** Air Thermistors
      2) **(2 per UV)** Refrigerant sensors
   viii. Interlock between LEV Control Box & UV DDC Controller
   ix. Communication bus [wireless – Factory installed WCI]

c) (22) Exhaust fan (EF-x) control to include Start/Stop control and Status monitoring. To include the field installation of (5) DDC Controllers, field Installed WCI, and enclosures.

3) PROJECT SPECIFIC NOT INCLUDED:

a) Existing Building Management System checkout and testing. Testing, if required, must be provided by Siemens.
b) Graphics. Graphics will be provided by Siemens.
c) Upgrades to existing control systems.
d) All work associated with existing building equipment.
e) All work associated with any existing building management systems.
f) Integration into existing Building Management Systems. Work must be provided by Siemens, if required.
g) All work associated with existing pneumatics.
h) All work associated with demolition.
i) All work associated with existing boiler plants. Boiler plants to operate as they are currently operating.

4) TRANE BUILDING AUTOMATION SYSTEM (BAS) CLARIFICATIONS:

a) **Project Management, Design Engineering, Field Engineering, and Operator Training Labor:**
   i. Trane has included factory-trained BAS Project Management, Project Engineering, and Field Technician labor required to deliver a functional control system as qualified in this proposal. Mechanical startup in not included unless otherwise specified above.

ii. Trane to provide factory standard engineered control submittals including product data sheets, and associated mechanical system sequence of operations. Any additional modifications or formatting that is not in the plans and specification are not included in this proposal.
iii. Project Management and field installation labor will be provided based upon project schedule and mechanical equipment field readiness.
iv. Trane has included an allowance, as stated above, for a field technician to assist the Balancing Contractor (BC) to connect their laptop for hydronic and air systems testing. This assistance includes helping the BC review the site, connect to the network and discover all devices. This assistance **DOES NOT** include a technician to work with the BC as they perform their work. The BC MUST possess their own laptop with a licensed copy of Trane balancing tool software. Contractor MUST provide Trane two weeks' notice for prior to scheduling. Trane will provide Time & Material billing based on published labor rates beyond the allotted allowance hours.
v. Trane to provide O&M manuals and as-built control submittal drawings upon completion of the project
vi. BAS Operator training allowance included as stated above. Additional training support hours are available on a T&M basis upon request. Training to be completed within (3) month of system acceptance.

b) **Electrical installation work clarifications:**

i. Trane has included 120 vac power wiring for **(0)** field mounted panels and electronic digital controllers in our scope of work. All other 120 vac end devices and panels are to be installed and wired by Division 26 Project Electrical Contractor, and **are not** included in this proposal.
ii. Trane is excluding power wiring of any kind (not listed above). Including but not limited to equipment, VAV boxes, DDC control panels and 120 vac control valve actuators
iii. BAS control wiring will be installed in EMT conduit in exposed mechanical spaces. For all other locations (i.e. ceilings and walls), wiring shall be installed with properly supported plenum rated cable outside of conduit.
iv. Outdoor control wiring shall be installed in galvanized rigid conduit or outdoor rated EMT that meets the National Electric Code requirements for the location of the project.
v. Trane has not included any labor associated with trenching required for underground conduits
vi. Trane electrical installation labor includes cleanup labor to ensure the work areas are clean of debris at the end of each working day. It has been assumed by Trane, the GC/CM for the project will be providing central collection areas for all project related debris.

c) **Warranty/Service Agreement**

i. Includes a one-year parts & labor warranty against defects in material & workmanship on all new, Trane provided, field-installed, DDC controllers and components. Warranty repair and replacement labor will occur during normal working hours.
ii. Warranty will end 18 months from shipment date or 12 months beginning with the date of beneficial use, whichever comes first.
iii. In the event of construction phasing of this project, each DDC system in a completed Phase will be warranted for 12 months, beginning with the date of beneficial use.
iv. BAS parts & labor warranty applies to field-installed controls only. Please refer to the equipment proposal for warranty coverage of the DDC controls factory supplied with the HVAC equipment.
v. Extended warranties are available upon specific requests
vi. Trane has not included an in-warranty service agreement within this proposal that includes Trane Intelligent Services, and/or Occupancy Adjustment visits to ensure proper operation during the warranty period described above.

d) **Clarifications:**

i. Trane is unable to release control submittals, order any materials or provide field labor until the tax determination for the project has been confirmed. If the project is exempt of taxes, Trane must be given appropriate state exempt forms at the onset of the project
ii. Trane will begin control submittals after the receipt of all approved Trane, non-Trane equipment submittals, and a detailed project schedule.
iii. Trane's BAS proposal and pricing is based upon Trane providing the HVAC equipment, with factory installed & tested controls, as described in this proposal. If non-Trane HVAC equipment is provided, Trane reserves the right to modify this proposal and subsequent pricing based upon the mechanical equipment being provided.
iv. Non-Trane systems being integrated to the BMS will come with the necessary material, labor and technical support to facilitate the integration to the BMS at no cost to Trane.

v. Trane has included our standard start-up and checkout labor practices for this project. Upon requiring coordination, documentation, and/or demonstration of systems performance to a designated Commissioning Agent Trane reserves the right to modify our pricing. A meeting is to be established to outline the method and documentation required for the commissioning work required.

e) **NOT Included:**

i. Providing, wiring, controlling or monitoring of any equipment/devices not included in the above scope
ii. Furnishing of PC or laptop computer for interface with BAS (refer to scope of work above).
iii. Electrical installation labor and material not included in the above scope.
iv. Interfacing to another BAS, to include any third party devices, software/hardware and any associated wiring and labor associated with integration
v. Startup, testing, troubleshooting or commissioning of equipment and devices not furnished by Trane. This includes miscellaneous control wiring provided by Trane for third party items
vi. Furnishing Variable Frequency Drives, starters, HOA switches, disconnects and/or associated electrical power wiring or integration.
vii. Installation of valves, dampers, pipe pressure taps, temperature sensor wells, pressure sensor/switch/transducer line sensor tubing and air flow measuring station
viii. Furnishing of control dampers
ix. Furnishing or installation of manufacturer supplied Boiler equipment, safeties, integral controls, gas train controls emergency shutoff switches, remote components and boiler circulating pumps control and associated wiring
x. Installation and furnishing of Boiler Safety Glass Shutdown and associated wiring
xi. Boiler combustion dampers, control and associated wiring
xii. Humidifier, Steam Generator, associated instruments, safety wiring and associated devices, utility piping, electrical power wiring, remote panel installation, or start-up labor
xiii. Stairwell pressurization control and any associated wiring
xiv. Air compressor and associated field devices with existing pneumatic system
xv. Sales Taxes
xvi. Alternate(s)/Add Alternate(s) are not included in the base scope
xvii. Fire, Smoke and/or Fire/Smoke dampers and any associated wiring
xviii. Exhaust Fans Dampers and associated wiring
xix. Smoke detectors; interface wiring with fire alarm system; smoke purge initiation
xx. Trenching required for underground conduit installation
xxi. Any cost associated with liquidated damages
xxii. Bid, Performance, or Payment Bonds
xxiii. Access doors
xxiv. Calibration certificates for any control devices
xxv. Demolition; excavation, roof penetrations; ceiling tile removal or replacement, cutting, patching and painting
xxvi. Checkout, repair, replacement or warranty of existing equipment
xxvii. Accelerated shipping costs
xxviii. Temporary, Standby or Overtime Labor; *All work figured to be done during normal working hours(7am to 3:30pm)*

Mechanical Equipment

Tag Data - VUVE Unit Ventilator (UV) (Qty: 51)

Item	Tag(s)	Qty	Description	Model Number
A1	UV-3, UV-23, UV-51A, UV-57, UV-58, UV-58A, UV-58B	7	VUVE Unit Ventilator (UV)	VUVE0750
A2	UV-1, UV-2, UV-4, UV-5, UV-6, UV-7, UV-8, UV-9, UV-10, UV-11, UV-12, UV-13, UV-14, UV-15, UV-16, UV-17, UV-18, UV-19, UV-20, UV-21, UV-22, UV-24, UV-41, UV-42-1, UV-42-2, UV-48, UV-49, UV-50	28	VUVE Unit Ventilator (UV)	VUVE1500
A3	UV-61, UV-46-1, UV-46-2	3	VUVE Unit Ventilator (UV)	VUVE1000
A4	UV-25, UV-30, UV-31, UV-32, UV-33, UV-34, UV-35, UV-36, UV-37, UV-38, UV-39, UV-40, UV-51	13	VUVE Unit Ventilator (UV)	VUVE1250

Product Data - VUVE Unit Ventilator (UV)
All Units

Vertical unit ventilator
115v/60hz/1ph
Return air front/fresh air back
DX cooling with HW heating
Lev Kit cooling coil
ECM & Low FLA
Toggle disconnect switch
2-Way, Modulating
Discharge grille with wire mesh
Modulating outside air damper
Symbio 400-B with Air-Fi WCI
Wireless sensor
21.25" depth with full sheetmetal back
21.25" deep end covers
Insulated front panel
Deluxe Piping Package
Auxiliary drain pan
Throwaway filter (A1 750 CFM ONLY)
MERV 13 FILTER (A2, A3, A4 ONLY)
Startup and Warranty by NJ Trane Service

NOT Included: Smoke detectors, crossover piping, wall sleeves, wall boxes, recessing flange, shelving, external vibration isolation, rigging/receiving, subbases, spare parts.

Tag Data - 18 inch piping cabinet (Qty: 51)

Item	Tag(s)	Qty	Description	Model Number
B1	18 inch	51	**18 inch piping cabinet**	SHLB5700

Product Data - Unit Ventilator Shelving Units
Item: B1 Qty: 51 Tag(s): 18 inch piping cabinet

18 inch piping cabinet (Field Installed by contractor)
21.25" [540mm] deep piping compartment
Louver Front Kickplate (no side) (Field Installed by contractor)

NOT Included: Top panel, rigging/receiving, spare parts and startup/service/warranty labor.

Tag Data - Linear Expansion Valve Kit (Qty: 51)

Item	Tag(s)	Qty	Description
C1	UV-14, UV-15, UV-16, UV-17, UV-18, UV-19, UV-20, UV-21, UV-22, UV-23, UV-25, UV-1, UV-2, UV-3, UV-5, UV-6, UV-7, UV-8, UV-9, UV-10, UV-11, UV-12, UV-13, UV-57, UV-46F-1, UV-46F-2, UV-58, UV-31, UV-33, UV-35, UV-37, UV-39, UV-41, UV-42-1, UV-30, UV-32, UV-34, UV-36, UV-38, UV-40, UV-42-2, UV-48, UV-49, UV-50, UV-51, UV-61	46	Linear Expansion Valve Kit (JV_LEV)
C2	UV-24, UV-4, UV-58B, UV-58A, UV-51A	5	Linear Expansion Valve Kit (JV_LEV)

Product Data - Linear Expansion Valve Kit
All Units

1 PAC-AH001-1 LEV Controller (Field Installed by contractor)

Item: C1 Qty: 46 Tag(s): UV-14, UV-15, UV-16, UV-17, UV-18, UV-19, UV-20, UV-21, UV-22, UV-23, UV-25, UV-1, UV-2, UV-3, UV-5, UV-6, UV-7, UV-8, UV-9, UV-10, UV-11, UV-12, UV-13, UV-57, UV-46F-1, UV-46F-2, UV-58, UV-31, UV-33, UV-35, UV-37, UV-39, UV-41, UV-42-1, UV-30, UV-32, UV-34, UV-36, UV-38, UV-40, UV-42-2, UV-48, UV-49, UV-50, UV-51, UV-61

1 PAC-LV48AC-1 (Field Installed by contractor)

Item: C2 Qty: 5 Tag(s): UV-24, UV-4, UV-58B, UV-58A, UV-51A

1 PAC-LV24AC-1 (Field Installed by contractor)

Tag Data - VRF Indoor Unit (Qty: 26)

Item	Tag(s)	Qty	Description
D1	CC-2A, UV-50A, CC-60, CC-61A, CC-61B	5	VRF Indoor Unit (JV_IDU)
D2	AHU-28, AHU-27, AHU-46G, AHU-59, AHU-55, AHU-56, AHU-52A, AHU-ST, AHU-53C, AHU-PE	10	VRF Indoor Unit (JV_IDU)
D3	CC-44-2	1	VRF Indoor Unit (JV_IDU)
D4	CC-47, CC-46	2	VRF Indoor Unit (JV_IDU)
D5	CC-43-1, CC-43-2, CC-44-1	3	VRF Indoor Unit (JV_IDU)
D6	AHU-54, AHU-55E, AHU-54E	3	VRF Indoor Unit (JV_IDU)
D7	OA Unit 1, OA Unit 2	2	VRF Indoor Unit (JV_IDU)

Product Data - VRF Indoor Unit
All Units:

1 TAR-41 Programmable Thermostat (Field Installed by contractor)

Item: D1 Qty: 5 Tag(s): CC-2A, UV-50A, CC-60, CC-61A, CC-61B

TPLFYP005FM140A 4-Way Ceiling Cassette
1 PAC-SH59KF-E High Eff Filter Element (Field Installed by contractor)
1 PAC-SJ41TM-E-MULTI-FUNCTION CASEMENT (Field Installed by contractor)
1 TLP-18FAU-GRILL (PLFY-NFMU/SLZ-KF) (Field Installed by contractor)

Item: D2 Qty: 10 Tag(s): AHU-28, AHU-27, AHU-46G, AHU-59, AHU-55, AHU-56, AHU-52A, AHU-ST, AHU-53C, AHU-PE

TPKFYP024KM142A Wall-mounted Indoor Unit Indoor Unit
1 GOBI Condensate Pumps (Field Installed by contractor)

Item: D3 Qty: 1 Tag(s): CC-44-2

TPLFYP012FM140A 4-Way Ceiling Cassette Indoor Unit
1 PAC-SH59KF-E High Eff Filter Element (Field Installed by contractor)
1 PAC-SJ41TM-E-MULTI-FUNCTION CASEMENT (Field Installed by contractor)
1 TLP-18FAU-GRILL (PLFY-NFMU/SLZ-KF) (Field Installed by contractor)

Item: D4 Qty: 2 Tag(s): CC-47, CC-46

TPLFYP008FM140A 4-Way Ceiling Cassette Indoor Unit
1 PAC-SH59KF-E High Eff Filter Element (Field Installed by contractor)
1 PAC-SJ41TM-E-MULTI-FUNCTION CASEMENT (Field Installed by contractor)
1 TLP-18FAU-GRILL (PLFY-NFMU/SLZ-KF) (Field Installed by contractor)

Item: D5 Qty: 3 Tag(s): CC-43-1, CC-43-2, CC-44-1
TPLFYP005FM140B 4-Way Ceiling Cassette Indoor Unit
1 PAC-SH59KF-E High Eff Filter Element (Field Installed by contractor)
1 PAC-SJ41TM-E-MULTI-FUNCTION CASEMENT (Field Installed by contractor)
1 TLP-18FAU-GRILL (PLFY-NFMU/SLZ-KF) (Field Installed by contractor)

Item: D6 Qty: 3 Tag(s): AHU-54, AHU-55E, AHU-54E
TPKFYP004LM140B Wall Mounted Indoor Unit
1 GOBI Condensate Pumps (Field Installed by contractor)

Item: D7 Qty: 2 Tag(s): OA Unit 1, OA Unit 2
TPEFYP036OA140A Ceiling Concealed Ducted Indoor Unit

Tag Data - VRF Outdoor Unit (Qty: 9)

Item	Tag(s)	Qty	Description
E1	ACCU-1A, ACCU-1B, ACCU-3A, ACCU-3B	4	VRF Outdoor Unit (JV_ODU)
E2	ACCU-2, ACCU-6	2	VRF Outdoor Unit (JV_ODU)
E3	ACCU-5, ACCU-4	2	VRF Outdoor Unit (JV_ODU)
E4	ACCU-7	1	VRF Outdoor Unit (JV_ODU)

Product Data - VRF Outdoor Unit

Item: E1 Qty: 4 Tag(s): ACCU-1A, ACCU-1B, ACCU-3A, ACCU-3B
TURYE2163BN41A – Outdoor System
- TURYE1203AN40AN MODULE#1 Outdoor Unit
- TURYE0963AN41AN MODULE#2 Outdoor Unit

Item: E2 Qty: 2 Tag(s): ACCU-2, ACCU-6
TURYE2883BN41A – Outdoor System
- TURYE1443AN41AN MODULE#1 Outdoor Unit
- TURYE1443AN41AN MODULE#2 Outdoor Unit

Item: E3 Qty: 2 Tag(s): ACCU-5, ACCU-4
TURYE2643BN41A – Outdoor System
- TURYE1443AN41AN MODULE#1 Outdoor Unit
- TURYE1203AN41AN MODULE#2 Outdoor Unit

Item: E4 Qty: 1 Tag(s): ACCU-7
TUHYE0723AN41A – Outdoor System
- TUHYE0723AN41AN MODULE#1 Outdoor Unit

Tag Data - VRF Accessory (Qty: 1)

Item	Tag(s)	Qty	Description
F1	VRF Accessory	1	VRF Accessory (JV_ACC)

Product Data - VRF Accessory
Item: F1 Qty: 1 Tag(s): VRF Accessory
4 CMY-R200NCBK-TWINNING KIT (R2 EP/P192 TO 240 T/YSNU) (Field Installed by contractor)
4 CMY-R300NCBK-TWINNING KIT (R2 EP/P264 TO 336 T/YSNU) (Field Installed by contractor)
7 CMY-R302S-G1-REDUCER JA1 TYPE BC CONTROLLER (Field Installed by contractor)
1 CMY-R304S-G1-REDUCER KA1 TYPE BC CONTROLLER (Field Installed by contractor)
1 CMY-R305S-G1-REDUCER KA1 TYPE BC CONTROLLER WITH SUB (Field Installed by contractor)
1 CMY-R306S-G-REDUCER KB1 TYPE BC CONTROLLER (Field Installed by contractor)
92 BV38BBSI-3/8" BALL VALVE, BRAZED (Field Installed by contractor)
92 BV58BBSI-5/8" BALL VALVE, BRAZED (Field Installed by contractor)
32 WDN-2-Front and Rear Wind Deflectors for LG units (Field Installed by contractor)
8 SWDN-1-Side Wind Deflectors (Field Installed by contractor)
1 CMY-Y102LS-G2-CITY MULTI- BRANCH PIPE (Field Installed by contractor)

16 LAHN-3-Low Ambient Hood Assembly (master) for LG units (Field Installed by contractor)
16 LAHN-4-Low Ambient Hood Assembly (subordinate) for LG units (Field Installed by contractor)
1 LAHN-1-Low Ambient Hood Assembly (master) for SM/XL units (Field Installed by contractor)

Tag Data - VRF Branch Controller (Qty: 9)

Item	Tag(s)	Qty	Description
G1	VRF Branch Co	9	VRF Branch Controller (JV_BCU)

Product Data - VRF Branch Controller
Item: G1 Qty: 9 Tag(s): VRF Branch Controller

2 Accessory 8 Branch Main BC (Field Installed by contractor)
3 Accessory 12 Branch Main BC (Field Installed by contractor)
1 Accessory 4 Branch Sub BC (Field Installed by contractor)
1 Accessory 16 Branch Main BC (Field Installed by contractor)
1 TCMBM0108JA21N4 (Field Installed by contractor)
1 TCMBM1012JA21N4 (Field Installed by contractor)

Tag Data - VRF Controls (Qty: 1)

Item	Tag(s)	Qty	Description
H1	VRF Controls	1	VRF Controls (JV_CTRL)

Product Data - VRF Controls
Item: H1 Qty: 1 Tag(s): VRF Controls

1 LIC-BACNET EXPANSION
1 LIC-BACNET MASTER
1 TE-200A Centralized Controller (Field Installed by contractor)
1 TE-50A Expansion (Field Installed by contractor)

Proposal Clarifications and Exclusions:

- Proposal above does not include rigging and receiving of equipment. North Rockland CSD is responsible for receiving and unloading equipment.
- Proposal above does not include storage of equipment.
- Proposal above does not include extended warranties or delayed startup.
- Proposal above does not include stands, springs, rails, or pads for the VRF outdoor condensing units.
- Proposal above does not include shelving of any kind for the unit ventilators.
- Proposal above does not include VRF line sets. Refrigerant Piping is by the Installing Contractor.
- Proposal above does not include spare filters.
- Confirm Unit Ventilator Heating Control valve is 2 way or 3 ways prior to release.
- Confirm low FLA option for unit ventilators prior to release.
- Confirm if subbases are required on all unit ventilators prior to releasing.
- UV-57 is missing from the schedule and shown on the install first floor plan on drawing TES-M-01. Confirm if this staff room unit ventilator is not needed prior to release.
- Installation of all equipment is to be provided by others.
- Installing contractor is responsible for procuring and installing booster fans for the cassettes that are pulling fresh air directly from outside air louvers and are not served by other equipment. Power to the booster fans shall be provided by the Div 26 Electrical Contractor.
- Please refer to the complete scope for additional exclusions per product type.
- Graphics shall be provided by Siemens.
- Integration into the Siemens Building Management System shall be provided by Siemens. This work is not included in the Trane scope of work. A separate quote from Siemens will be required for this work.

Installation Responsibilities:

1) **The Installing Mechanical Contractor** is responsible for the removal of any existing DX valves factory-installed on-unit ventilator.
2) **The Installing Mechanical Contractor** is responsible for brazing of the Mitsubishi VRF LEV valve assemblies to the unit ventilator.
3) **Trane Controls** is responsible for field mounting of the Linear Expansion Valve Control Boxes.
4) **Trane Controls** is responsible for field installation of qty (4) VRF sensors for each LEV Control Box. This includes (2) air thermistors and (2) refrigerant sensors and wiring back to Linear Expansion Valve Control Boxes.
5) **Trane Controls** is responsible for wire interlock between LEV controller and LEV valve assemblies
6) **Trane Controls** is responsible for wire interlock between LEV controller and UC controller, and UC Controller to wall thermostat (if applicable).
7) **Trane Controls** is responsible for all M-net wiring.
8) **The Licensed Electrical Contractor** is responsible for bringing 208-230V power to the LEV Controller, in addition to the Unit Ventilator power.
9) **Trane Controls** is responsible for programming of UC Controller (if applicable).
10) **Trane Controls** is responsible for any interlock of 3rd party devices with UC Controller (if applicable)
11) **Trane Service** is responsible for the start-up of the traditional air handling device.
12) **The Installing Mechanical Contractor** is responsible for the start-up of the VRF components.
13) **Trane Controls** is responsible for the addressing of the VRF system
14) **The Installing Mechanical Contractor** is responsible for providing and installing unit ventilator condensate pumps.
15) **The Licensed Electrical Contractor** is responsible for providing power to condensate pumps, when required.

Not Included: Control integration/wiring, smoke detectors, refrigeration tees, filter boxes, wind baffles(unless otherwise noted), hail/snow guards, flow switches, secondary drain pans, secondary condensate overflow sensors, external condensate pumps (unless otherwise noted), disconnects, refrigerant piping specialties, hangers, refrigerant piping, water piping, hose kits/valves, insulation, isolation valves, watt-hour meters, tenant billing software, additional refrigerant, roof rails or curbs, condensing unit mounting brackets, humidity sensors, external vibration isolation, rigging/receiving, addressing, rotary dials, dipswitches, spare parts, service labor, installation labor, LEV installation, LEV sensor installation, extended warranty.

Ductless Warranty/Technical Installation Support

A. Site Review by Ductless Technical Specialist
   1. Pre-construction meeting with Trane Ductless Technical Specialist required to review site conditions, installation requirements, best practices, and pre-startup requirements.
   2. At least (1) jobsite review during installation with Trane Ductless Technical Specialist required.
   3. If it is found that the refrigerant pipe lengths on the submittal diagrams must be significantly modified to achieve installation in the field, the installing Contractor must provide updated estimated piping layout prior to installation of pipe.
   4. Installing Contractor must provide updated as-built piping layout required to complete the Diamond System Builder design file prior to start-up.
   5. **Owner-Training by Trane Service Department is not included unless otherwise noted.**

B. VRF City-Multi Start-Up Assistance by Ductless Technical Specialist
   1. **No start-up assistance included on Nv&P-Series Mini-Splits unless otherwise noted.**
   2. Trane can provide a Ductless Technical Specialist to supervise the start-up of up to 2 systems.
   3. Installing Contractor MUST have technicians on-site to perform mechanical start-up under the supervision of Trane. Technician must be equipped with Maintenance Tool and a Laptop.
   4. Installing Contractor must contact Ductless Technical Specialist to schedule VRF Assisted Start-Up no less than 2 weeks before requested start-up date.
   5. Installing contractor must submit completed Component Location Sheet and Prestart Checklist to Ductless Technical Specialist no later than 3-days prior to requested start-up date.
   6. Installing Contractor must verify system installations meet Trane-Mitsubishi requirements including but not limited to service clearances, pressure tests, vacuum tests, electrical power to units, wiring/piping connections, and refrigerant charge prior to start-up.
   7. No installation labor will be completed by Trane personnel unless otherwise noted.

8. City Multi and Nv&P-Series Service/Maintenance Tools not included unless otherwise noted.
9. Any additional labor required from Trane to complete start-up procedure will be billed separately.

Responsibilities of DTS at Assisted Start-Up:

1. Provide support to installing contractor as system start-up data is pulled into Maintenance Tool
2. Population of TE-200/TW-50 if applicable (any integration and programming by others)

Responsibilities of Installing Contractor at Assisted Start-Up:

1. Electrical Testing on outdoor units
2. Physical inspection of the outdoor units
3. Troubleshoot indoor units if there is an issue
4. Handling of additional refrigerant and adding of trim charge
5. **Setting addresses, dipswitches, and rotary dials on the Indoor units, Outdoor units, Controllers, and Branch Controllers.**
6. Performing of vacuum and pressure tests

C. Warranty

1. VRF City-Multi Standard Warranty is 1 year parts, 7 year compressor from the time of startup. VRF City-Multi Extended 10-Year Parts/Compressor Warranty will be applied if the following requirements are met:
   a. Installing Contractor completes a certified Trane-Mitsubishi 3-day City-Multi Installation/Service Course, and documents attendees and date of completion.
   b. The system is designed by a certified Diamond Designer using Diamond System Builder™
   c. The contractor generates a complete and approved METUS Extended Warranty Process Report from the Diamond System Builder software.

   (See Trane-Mitsubishi Warranty Policy for details.)
2. **Installing Contractor is responsible for completion of Diamond System Builder warranty filing and final submission to METUS Extended Warranty Department.**
3. Nv&P Series Standard Warranty is 5 year parts, 7 year compressor from the time of startup. Nv&P Series Extended 10-Year Parts/Compressor Warranty will be applied if the product is installed in a residential application and registered within 90 days of installation. See Nv-Series and P-Series Limited Warranty Policies for details.
4. No labor warranty is included here unless otherwise noted. Please contact your Trane Account Manager for availability.

Supplementary Guidelines

A. Purchasing Contractor and/or Consulting Engineer must validate unit voltages, model numbers, quantities, required accessories, and unit configurations prior to order.
B. Consulting Engineer/Architect and Installing Contractor must approve equipment submittals and system design prior to order, including but not limited to all code/standard compliances, system application (heat pump vs. heat recovery), service clearances, refrigerant concentration compliance, load analysis, unit configuration, and installation requirements.
C. Outdoor condensing units must be installed on stands at a minimum height of 12”. Ground installation or raised pads are not acceptable.
D. Insulation is required on all condensate piping and refrigerant piping including liquid lines, low pressure gas lines, and high pressure gas lines.
E. All M-Net Control Wiring must be 16AWG, 2-conductor, stranded, shielded cable (MA controllers allow 22-16AWG wire)
F. All BC-Controllers must have condensate drain line installed.
G. All Linear Expansion Valve kits require 208V/1ph power.
H. Additional units/accessories not included in the scope will be at an additional cost.
I. All TQ*YP Water Source units require a **field-supplied** flow switch and strainer. Water quality must be adequately maintained. See the METUS installation manual for full details.

Disclaimer:

To protect our climate and reduce emissions from hydrofluorocarbons (HFCs), the American Innovation & Manufacturing (AIM) Act directs the U.S. Environmental Protection Agency (EPA) to phase down the supply of HFCs. This proposal includes Mitsubishi Electric Trane HVAC Mini Split heat pump products that must comply with the AIM Act by transitioning to a next-generation refrigerants with less than 700 GWP, R-454B has a global warming potential of 466 and will replace the proposed R-410A mini split systems quoted on this

project when R-410A unit inventory is depleted. The AIM act mandates that manufacturers must discontinue manufacturing R-410A mini split heat pumps by December 31st 2024 and discontinue selling them by December 31st 2025. As such, Trane will begin to phase down the sale and distribution of R-410A mini splits in the 2025 calendar year and transition to R-454B mini splits when R-410A unit inventory is depleted. The above proposal includes R-410A product that will be subject to this transition. This pricing is only valid for the items listed on the proposal and is only valid until R-410A unit inventory is depleted. At such time, this proposal will need to be updated to include R-454B units. Please contact your Trane field Sales Representative for an updated quote/budget.

TERMS AND CONDITIONS – COMMERCIAL INSTALLATION

"Company" shall mean Trane U.S. Inc. for Work performed in the United States or Trane Canada ULC for Work performed in Canada.

1. Acceptance; Agreement. These terms and conditions are an integral part of Company's offer and form the basis of any agreement (the "Agreement") resulting from Company's proposal (the "Proposal") for the commercial goods and/or services described (the "Work"). COMPANY'S TERMS AND CONDITIONS AND EQUIPMENT PRICES ARE SUBJECT TO PERIODIC CHANGE OR AMENDMENT. The Proposal is subject to acceptance in writing by the party to whom this offer is made or an authorized agent ("Customer") delivered to Company within 30 days from the date of the Proposal. Prices in the Proposal are subject to change at any time upon notice to Customer. If Customer accepts the Proposal by placing an order, without the addition of any other terms and conditions of sale or any other modification, Customer's order shall be deemed acceptance of the Proposal subject to Company's terms and conditions. If Customer's order is expressly conditioned upon Company's acceptance or assent to terms and/or conditions other than those expressed herein, return of such order by Company with Company's terms and conditions attached or referenced serves as Company's notice of objection to Customer's terms and as Company's counteroffer to provide Work in accordance with the Proposal and the Company terms and conditions. If Customer does not reject or object in writing to Company within 10 days, Company's counteroffer will be deemed accepted. Notwithstanding anything to the contrary herein, Customer's acceptance of the Work by Company will in any event constitute an acceptance by Customer of Company's terms and conditions. This Agreement is subject to credit approval by Company. Upon disapproval of credit, Company may delay or suspend performance or, at its option, renegotiate prices and/or terms and conditions with Customer. If Company and Customer are unable to agree on such revisions, this Agreement shall be cancelled without any liability, other than Customer's obligation to pay for Work rendered by Company to the date of cancellation.

2. Connected Services. In addition to these terms and conditions, the Connected Services Terms of Service ("Connected Services Terms"), available at https://www.trane.com/TraneConnectedServicesTerms, as updated from time to time, are incorporated herein by reference and shall apply to the extent that Company provides Customer with Connected Services, as defined in the Connected Services Terms.

3. Title and Risk of Loss. All Equipment sales with destinations to Canada or the U.S. shall be made as follows: FOB Company's U.S. manufacturing facility or warehouse (full freight allowed). Title and risk of loss or damage to Equipment will pass to Customer upon tender of delivery of such to carrier at Company's U.S. manufacturing facility or warehouse.

4. Pricing and Taxes. Unless otherwise noted, the price in the Proposal includes standard ground transportation and, if required by law, all sales, consumer, use and similar taxes legally enacted as of the date hereof for equipment and material installed by Company. Tax exemption is contingent upon Customer furnishing appropriate certificates evidencing Customer's tax-exempt status. Company shall charge Customer additional costs for bonds agreed to be provided. Equipment sold on an uninstalled basis and any taxable labor/labour do not include sales tax and taxes will be added. Within thirty (30) days following Customer acceptance of the Proposal without addition of any other terms and conditions of sale or any modification, Customer shall provide notification of release for immediate production at Company's factory. Prices for Work are subject to change at any time prior to shipment to reflect any cost increases related to the manufacture, supply, and shipping of goods. This includes, but is not limited to, cost increases in raw materials, supplier components, labor, utilities, freight, logistics, wages and benefits, regulatory compliance, or any other event beyond Company's control. If such release is not received within 6 months after date of order receipt, Company reserves the right to cancel any order. If shipment is delayed due to Customer's actions, Company may also charge Customer storage fees. Company shall be entitled to equitable adjustments in the contract price to reflect any cost increases as set forth above and will provide notice to Customer prior to the date for which the increased price is to be in effect for the applicable customer contract. In no event will prices be decreased.

5. Exclusions from Work. Company's obligation is limited to the Work as defined and does not include any modifications to the Work site under the Americans With Disabilities Act or any other law or building code(s). In no event shall Company be required to perform work Company reasonably believes is outside of the defined Work without a written change order signed by Customer and Company.

6. Performance. Company shall perform the Work in accordance with industry standards generally applicable in the area under similar circumstances as of the time Company performs the Work. Company may refuse to perform any Work where working conditions could endanger property or put at risk the safety of persons. Unless otherwise agreed to by Customer and Company, at Customer's expense and before the Work begins, Customer will provide any necessary access platforms, catwalks to safely perform the Work in compliance with OSHA or state industrial safety regulations.

7. Payment. Customer shall pay Company's invoices within net 30 days of invoice date. Company may invoice Customer for all equipment or material furnished, whether delivered to the installation site or to an off-site storage facility and for all Work performed on-site or off-site. No retention shall be withheld from any payments except as expressly agreed in writing by Company, in which case retention shall be reduced per the contract documents and released no later than the date of substantial completion. Under no circumstances shall any retention be withheld for the equipment portion of the order. If payment is not received as required, Company may suspend performance and the time for completion shall be extended for a reasonable period of time not less than the period of suspension. Customer shall be liable to Company for all reasonable shutdown, standby and start-up costs as a result of the suspension. Company reserves the right to add to any account outstanding for more than 30 days a service charge equal to 1.5% of the principal amount due at the end of each month. Customer shall pay all costs (including attorneys' fees) incurred by Company in attempting to collect amounts due and otherwise enforcing these terms and conditions. If requested, Company will provide appropriate lien waivers upon receipt of payment. Customer agrees that, unless Customer makes payment in advance, Company will have a purchase money security interest in all equipment from Company to secure payment in full of all amounts due Company and its order for the equipment, together with these terms and conditions, form a security agreement. Customer shall keep the equipment free of all taxes and encumbrances, shall not remove the equipment from its original installation point and shall not assign or transfer any interest in the equipment until all payments due Company have been made.

8. Time for Completion. Except to the extent otherwise expressly agreed in writing signed by an authorized representative of Company, all dates provided by Company or its representatives for commencement, progress or completion are estimates only. While Company shall use commercially reasonable efforts to meet such estimated dates, Company shall not be responsible for any damages for its failure to do so. Delivery dates are approximate and not guaranteed. Company will use commercially reasonable efforts to deliver the Equipment on or before the estimated delivery date, will notify Customer if the estimated delivery dates cannot be honored, and will deliver the Equipment and services as soon as practicable thereafter. In no event will Company be liable for any damages or expenses caused by delays in delivery.

9. Access. Company and its subcontractors shall be provided access to the Work site during regular business hours, or such other hours as may be requested by Company and acceptable to the Work site' owner or tenant for the performance of the Work, including sufficient areas for staging, mobilization, and storage. Company's access to correct any emergency condition shall not be restricted. Customer grants to Company the right to remotely connect (via phone modem, internet or other agreed upon means) to Customer's building automation system (BAS) and or HVAC equipment to view, extract, or otherwise collect and retain data from the BAS, HVAC equipment, or other building systems, and to diagnose and remotely make repairs at Customer's request.

10. Completion. Notwithstanding any other term or condition herein, when Company informs Customer that the Work has been completed, Customer shall inspect the Work in the presence of Company's representative, and Customer shall either (a) accept the Work in its entirety in writing, or (b) accept the Work in part and specifically identify, in writing, any exception items. Customer agrees to re-inspect any and all excepted items as soon as Company informs Customer that all such excepted items have been completed. The initial acceptance inspection shall take place within ten (10) days from the date when Company informs Customer that the Work has been completed. Any subsequent re-inspection of excepted items shall take place within five (5) days from the date when Company informs Customer that the excepted items have been completed. Customer's failure to cooperate and complete any of said inspections within the required time limits shall constitute complete acceptance of the Work as of ten (10) days from date when Company informs Customer that the Work, or the excepted items, if applicable, has/have been completed.

11. Permits and Governmental Fees. Company shall secure (with Customer's assistance) and pay for building and other permits and governmental fees, licenses, and inspections necessary for proper performance and completion of the Work which are legally required when bids from Company's subcontractors are received, negotiations thereon concluded, or the effective date of a relevant Change Order, whichever is later. Customer is responsible for necessary approvals, easements, assessments and charges for construction, use or occupancy of permanent structures or for permanent changes to existing facilities. If the cost of such permits, fees, licenses and inspections are not included in the Proposal, Company will invoice Customer for such costs.

12. Utilities During Construction. Customer shall provide without charge to Company all water, heat, and utilities required for performance of the Work.

13. Concealed or Unknown Conditions. In the performance of the Work, if Company encounters conditions at the Work site that are (i) subsurface or otherwise concealed physical conditions that differ materially from those indicated on drawings expressly incorporated herein or (ii) unknown physical conditions of an unusual nature that differ materially from those conditions ordinarily found to exist and generally recognized as inherent in construction activities of the type and character as the Work, Company shall notify Customer of such conditions promptly, prior to significantly disturbing same. If such conditions differ materially and cause an increase in Company's cost of, or time required for, performance of any part of the Work, Company shall be entitled to, and Customer shall consent by Change Order to, an equitable adjustment in the Contract Price, contract time, or both.

14. Pre-Existing Conditions. Company is not liable for any claims, damages, losses, or expenses, arising from or related to conditions that existed in, on, or upon the Work site before the Commencement Date of this Agreement ("Pre-Existing Conditions"), including, without limitation, damages, losses, or expenses involving Pre-Existing Conditions of building envelope issues, mechanical issues, plumbing issues, and/or indoor air quality issues involving mold/mould and/or fungi. Company also is not liable for any claims, damages, losses, or expenses, arising from or related to work done by or services provided by individuals or entities that are not employed by or hired by Company.

15. Asbestos and Hazardous Materials. Company's Work and other services in connection with this Agreement expressly excludes any identification, abatement, cleanup, control, disposal, removal or other work connected with asbestos, polychlorinated biphenyl ("PCB"), or other hazardous materials (hereinafter, collectively, "Hazardous Materials"). Customer warrants and represents that, except as set forth in a writing signed by Company, there are no Hazardous Materials on the Work site

that will in any way affect Company's Work and Customer has disclosed to Company the existence and location of any Hazardous Materials in all areas within which Company will be performing the Work. Should Company become aware of or suspect the presence of Hazardous Materials, Company may immediately stop work in the affected area and shall notify Customer. Customer will be exclusively responsible for taking any and all action necessary to correct the condition in accordance with all applicable laws and regulations. Customer shall be exclusively responsible for and, to the fullest extent permitted by law, shall indemnify and hold harmless Company (including its employees, agents and subcontractors) from and against any loss, claim, liability, fees, penalties, injury (including death) or liability of any nature, and the payment thereof arising out of or relating to any Hazardous Materials on or about the Work site, not brought onto the Work site by Company. Company shall be required to resume performance of the Work in the affected area only in the absence of Hazardous Materials or when the affected area has been rendered harmless. In no event shall Company be obligated to transport or handle Hazardous Materials, provide any notices to any governmental agency, or examine the Work site for the presence of Hazardous Materials.

16. Force Majeure. Company's duty to perform under this Agreement is contingent upon the non-occurrence of an Event of Force Majeure. If Company shall be unable to carry out any material obligation under this Agreement due to an Event of Force Majeure, this Agreement shall at Company's election (i) remain in effect but Company's obligations shall be suspended until the uncontrollable event terminates or (ii) be terminated upon 10 days' notice to Customer, in which event Customer shall pay Company for all parts of the Work furnished to the date of termination. An "Event of Force Majeure" shall mean any cause or event beyond the control of Company. Without limiting the foregoing, "Event of Force Majeure" includes: acts of God; acts of terrorism, war or the public enemy; flood; earthquake; tornado; storm; fire; civil disobedience; pandemic insurrections; riots; labor/labour disputes; labor/labour or material shortages; sabotage; restraint by court order or public authority (whether valid or invalid), and action or non-action by or inability to obtain or keep in force the necessary governmental authorizations, permits, licenses, certificates or approvals if not caused by Company; and the requirements of any applicable government in any manner that diverts either the material or the finished product to the direct or indirect benefit of the government.

17. Customer's Breach. Each of the following events or conditions shall constitute a breach by Customer and shall give Company the right, without an election of remedies, to terminate this Agreement or suspend performance by delivery of written notice: (1) Any failure by Customer to pay amounts when due; or (2) any general assignment by Customer for the benefit of its creditors, or if Customer becomes bankrupt or insolvent or takes the benefit of any statute for bankrupt or insolvent debtors, or makes or proposes to make any proposal or arrangement with creditors, or if any steps are taken for the winding up or other termination of Customer or the liquidation of its assets, or if a trustee, receiver, or similar person is appointed over any of the assets or interests of Customer; (3) Any representation or warranty furnished by Customer in this Agreement is false or misleading in any material respect when made; or (4) Any failure by Customer to perform or comply with any material provision of this Agreement. Customer shall be liable to Company for all Work furnished to date and all damages sustained by Company (including lost profit and overhead)

18. Indemnity. To the fullest extent permitted by law, Company and Customer shall indemnify, defend and hold harmless each other from any and all claims, actions, costs, expenses, damages and liabilities, including reasonable attorneys' fees, resulting from death or bodily injury or damage to real or tangible personal property, to the extent caused by the negligence or misconduct of their respective employees or other authorized agents in connection with their activities within the scope of this Agreement. Neither party shall indemnify the other against claims, damages, expenses or liabilities to the extent attributable to the acts or omissions of the other party. If the parties are both at fault, the obligation to indemnify shall be proportional to their relative fault. The duty to indemnify will continue in full force and effect, notwithstanding the expiration or early termination hereof, with respect to any claims based on facts or conditions that occurred prior to expiration or termination.

19. Limitation of Liability. NOTWITHSTANDING ANYTHING TO THE CONTRARY, IN NO EVENT SHALL COMPANY BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT CONSEQUENTIAL, OR PUNITIVE OR EXEMPLARY DAMAGES (INCLUDING WITHOUT LIMITATION BUSINESS INTERRUPTION, LOST DATA, LOST REVENUE, LOST PROFITS, LOST DOLLAR SAVINGS, OR LOST ENERGY USE SAVINGS, INCLUDING CONTAMINANTS LIABILITIES, EVEN IF A PARTY HAS BEEN ADVISED OF SUCH POSSIBLE DAMAGES OR IF SAME WERE REASONABLY FORESEEABLE AND REGARDLESS OF WHETHER THE CAUSE OF ACTION IS FRAMED IN CONTRACT, NEGLIGENCE, ANY OTHER TORT, WARRANTY, STRICT LIABILITY, OR PRODUCT LIABILITY). In no event will Company's liability in connection with the provision of products or services or otherwise under this Agreement exceed the entire amount paid to Company by Customer under this Agreement.

20. CONTAMINANTS LIABILITY

The transmission of COVID-19 may occur in a variety of ways and circumstances, many of the aspects of which are currently not known. HVAC systems, products, services and other offerings have not been tested for their effectiveness in reducing the spread of COVID-19, including through the air in closed environments. **IN NO EVENT WILL COMPANY BE LIABLE UNDER THIS AGREEMENT OR OTHERWISE FOR ANY INDEMNIFICATION, ACTION OR CLAIM, WHETHER BASED ON WARRANTY, CONTRACT, TORT OR OTHERWISE, FOR ANY BODILY INJURY (INCLUDING DEATH), DAMAGE TO PROPERTY, OR ANY OTHER LIABILITIES, DAMAGES OR COSTS RELATED TO CONTAMINANTS (INCLUCING THE SPREAD, TRANSMISSION, MITIGATION, ELIMINATION, OR CONTAMINATION THEREOF) (COLLECTIVELY, "CONTAMINANT LIABILITIES") AND CUSTOMER HEREBY EXPRESSLY RELEASES COMPANY FROM ANY SUCH CONTAMINANTS LIABILITIES.**

21. Patent Indemnity. Company shall protect and indemnify Customer from and against all claims, damages, judgments and loss arising from infringement or alleged infringement of any United States patent by any of the goods manufactured by Company and delivered hereunder, provided that in the event of suit or threat of suit for patent infringement, Company shall promptly be notified and given full opportunity to negotiate a settlement. Company does not warrant against infringement by reason of Customer's design of the articles or the use thereof in combination with other materials or in the operation of any process. In the event of litigation, Customer agrees to reasonably cooperate with Company. In connection with any proceeding under the provisions of this Section, all parties concerned shall be entitled to be represented by counsel at their own expense.

22. Limited Warranty. Company warrants for a period of 12 months from the date of substantial completion ("Warranty Period") commercial equipment manufactured and installed by Company against failure due to defects in material and manufacture and that the labor/labour furnished is warranted to have been properly performed (the "Limited Warranty"). Trane equipment sold on an uninstalled basis is warranted in accordance with Company's standard warranty for supplied equipment. **Product manufactured by Company that includes required startup and is sold in North America will not be warranted by Company unless Company performs the product start-up**. Substantial completion shall be the earlier of the date that the Work is sufficiently complete so that the Work can be utilized for its intended use or the date that Customer receives beneficial use of the Work. If such defect is discovered within the Warranty Period, Company will correct the defect or furnish replacement equipment (or, at its option, parts therefor) and, if said equipment was installed pursuant hereto, labor/labour associated with the replacement of parts or equipment not conforming to this Limited Warranty. Defects must be reported to Company within the Warranty Period. Exclusions from this Limited Warranty include damage or failure arising from: wear and tear; corrosion, erosion, deterioration; Customer's failure to follow the Company-provided maintenance plan; refrigerant not supplied by Company; and modifications made by others to Company's equipment. Company shall not be obligated to pay for the cost of lost refrigerant. Notwithstanding the foregoing, all warranties provided herein terminate upon termination or cancellation of this Agreement. No warranty liability whatsoever shall attach to Company until the Work has been paid for in full and then said liability shall be limited to the lesser of Company's cost to correct the defective Work and/or the purchase price of the equipment shown to be defective. Equipment, material and/or parts that are not manufactured by Company ("Third-Party Product(s)" are not warranted by Company and have such warranties as may be extended by the respective manufacturer. **CUSTOMER UNDERSTANDS THAT COMPANY IS NOT THE MANUFACTURER OF ANY THIRD-PARTY PRODUCT(S) AND ANY WARRANTIES, CLAIMS, STATEMENTS, REPRESENTATIONS, OR SPECIFICATIONS ARE THOSE OF THE THIRD-PARTY MANUFACTURER, NOT COMPANY AND CUSTOMER IS NOT RELYING ON ANY WARRANTIES, CLAIMS, STATEMENTS, REPRESENTATIONS, OR SPECIFICATIONS REGARDING THE THIRD-PARTY PRODUCT THAT MAY BE PROVIDED BY COMPANY OR ITS AFFILIATES, WHETHER ORAL OR WRITTEN. THE WARRANTY AND LIABILITY SET FORTH IN THIS AGREEMENT ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESS OR IMPLIED, IN LAW OR IN FACT, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND/OR OTHERS ARISING FROM COURSE OF DEALING OR TRADE. COMPANY MAKES NO REPRESENTATION OR WARRANTY .OF ANY KIND, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. ADDITIONALLY, COMPANY MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND REGARDING PREVENTING, ELIMINATING, REDUCING OR INHIBITING ANY MOLD, FUNGUS, BACTERIA, VIRUS, MICROBIAL GROWTH, OR ANY OTHER CONTAMINANTS (INCLUDING COVID-19 OR ANY SIMILAR VIRUS) (COLLECTIVELY, "CONTAMINANTS"), WHETHER INVOLVING OR IN CONNECTION WITH EQUIPMENT, ANY COMPONENT THEREOF, SERVICES OR OTHERWISE. IN NO EVENT SHALL COMPANY HAVE ANY LIABILITY FOR THE PREVENTION, ELIMINATION, REDUCTION OR INHIBITION OF THE GROWTH OR SPREAD OF SUCH CONTAMINANTS INVOLVING OR IN CONNECTION WITH ANY EQUIPMENT, THIRD-PARTY PRODUCT, OR ANY COMPONENT THEREOF, SERVICES OR OTHERWISE AND CUSTOMER HEREBY SPECIFICALLY ACKNOWLDGES AND AGREES THERETO.**

23. Insurance. Company agrees to maintain the following insurance while the Work is being performed with limits not less than shown below and will, upon request from Customer, provide a Certificate of evidencing the following coverage:

Commercial General Liability	$2,000,000 per occurrence
Automobile Liability	$2,000,000 CSL
Workers Compensation	Statutory Limits

If Customer has requested to be named as an additional insured under Company's insurance policy, Company will do so but only subject to Company's manuscript additional insured endorsement under its primary Commercial General Liability policies. In no event does Company waive its right of subrogation.

24. Commencement of Statutory Limitation Period. Except as to warranty claims, as may be applicable, any applicable statutes of limitation for acts or failures to act shall commence to run, and any alleged cause of action stemming therefrom shall be deemed to have accrued, in any and all events not later than the last date that Company or its subcontractors physically performed work on the project site.

25. General. Except as provided below, to the maximum extent provided by law, this Agreement is made and shall be interpreted and enforced in accordance with the laws of the state or province in which the Work is performed, without regard to choice of law principles which might otherwise call for the application of a different state's or province's law. Any dispute arising under or relating to this Agreement that is not disposed of by agreement shall be decided by litigation in a court of competent jurisdiction located in the state or province in which the Work is performed. To the extent the Work site is owned and/or operated by any agency of the Federal Government, determination of any substantive issue of law shall be according to the Federal common law of Government contracts as enunciated and applied by Federal judicial bodies and boards of contract appeals of the Federal Government. This Agreement contains all of the agreements, representations and understandings of the parties and supersedes all previous understandings, commitments or agreements, oral or written, related to the subject matter hereof. This Agreement may not be amended, modified or terminated except by a writing signed by the parties hereto. No documents shall be incorporated herein by reference except to the extent Company is a signatory thereon. If any term or condition of this Agreement is invalid, illegal or incapable of being enforced by any rule of law, all other terms and conditions of this Agreement will nevertheless remain in full force and effect as long as the economic or legal substance of the transaction contemplated hereby is not affected in a manner adverse to any party hereto. Customer may not assign, transfer, or convey this Agreement, or any part hereof, or its right, title or interest herein, without the written consent of the Company. Subject to the foregoing, this Agreement shall be binding upon and inure to the benefit of Customer's permitted successors and assigns. This Agreement may be executed in several counterparts, each of which when executed shall be deemed to be an original, but all together shall constitute but one and the same Agreement. A fully executed facsimile copy hereof or the several counterparts shall suffice as an original.

26. Equal Employment Opportunity/Affirmative Action Clause. Company is a federal contractor that complies fully with Executive Order 11246, as amended, and the applicable regulations contained in 41 C.F.R. Parts 60-1 through 60-60, 29 U.S.C. Section 793 and the applicable regulations contained in 41 C.F.R. Part 60-741; and 38 U.S.C. Section 4212 and the applicable regulations contained in 41 C.F.R. Part 60-250 Executive Order 13496 and Section 29 CFR 471, appendix A to subpart A, regarding the notice of employee rights in the United States and with Canadian Charter of Rights and Freedoms Schedule B to the Canada Act 1982 (U.K.) 1982, c. 11 and applicable Provincial Human Rights Codes and employment law in Canada.

27. U.S. Government Work.

The following provision applies only to direct sales by Company to the US Government. The Parties acknowledge that all items or services ordered and delivered under this Agreement are Commercial Items as defined under Part 12 of the Federal Acquisition Regulation (FAR). In particular, Company agrees to be bound only by those Federal contracting clauses that apply to "commercial" suppliers and that are contained in FAR 52.212-5(e)(1). Company complies with 52.219-8 or 52.219-9 in its service and installation contracting business.

The following provision applies only to indirect sales by Company to the US Government. As a Commercial Item Subcontractor, Company accepts only the following mandatory flow down provisions in effect as of the date of this subcontract: 52.203-19; 52.204-21; 52.204-23; 52.219-8; 52.222-21; 52.222-26; 52.222-35; 52.222-36; 52.222-50; 52.225-26; 52.247-64. If the Work is in connection with a U.S. Government contract, Customer certifies that it has provided and will provide current, accurate, and complete information, representations and certifications to all government officials, including but not limited to the contracting officer and officials of the Small Business Administration, on all matters related to the prime contract, including but not limited to all aspects of its ownership, eligibility, and performance. Anything herein notwithstanding, Company will have no obligations to Customer unless and until Customer provides Company with a true, correct and complete executed copy of the prime contract. Upon request, Customer will provide copies to Company of all requested written communications with any government official related to the prime contract prior to or concurrent with the execution thereof, including but not limited to any communications related to Customer's ownership, eligibility or performance of the prime contract. Customer will obtain written authorization and approval from Company prior to providing any government official any information about Company's performance of the work that is the subject of the Proposal or this Agreement, other than the Proposal or this Agreement.

28. Limited Waiver of Sovereign Immunity. If Customer is an Indian tribe (in the U.S.) or a First Nation or Band Council (in Canada), Customer, whether acting in its capacity as a government, governmental entity, a duly organized corporate entity or otherwise, for itself and for its agents, successors, and assigns: (1) hereby provides this limited waiver of its sovereign immunity as to any damages, claims, lawsuit, or cause of action (herein "Action") brought against Customer by Company and arising or alleged to arise out of the furnishing by Company of any product or service under this Agreement, whether such Action is based in contract, tort, strict liability, civil liability or any other legal theory; (2) agrees that jurisdiction and venue for any such Action shall be proper and valid (a) if Customer is in the U.S., in any state or United States court located in the state in which Company is performing this Agreement or (b) if Customer is in Canada, in the superior court of the province or territory in which the work was performed; (3) expressly consents to such Action, and waives any objection to jurisdiction or venue; (4) waives any requirement of exhaustion of tribal court or administrative remedies for any Action arising out of or related to this Agreement; and (5) expressly acknowledges and agrees that Company is not subject to the jurisdiction of Customer's tribal court or any similar tribal forum, that Customer will not bring any action against Company in tribal court, and that Customer will not avail itself of any ruling or direction of the tribal court permitting or directing it to suspend its payment or other obligations under this Agreement. The individual signing on behalf of Customer warrants and represents that such individual is duly authorized to provide this waiver and enter into this Agreement and that this Agreement constitutes the valid and legally binding obligation of Customer, enforceable in accordance with its terms.

29. Building Automation Systems and Network Security. Customer and Trane acknowledge that Building Automation System (BAS) and connected networks security requires Customer and Trane to maintain certain cybersecurity obligations. Customer acknowledges that upon completion of installation and configuration of the BAS, the Customer maintains ownership of the BAS and the connected network equipment. Except for any applicable warranty obligations, Customer is solely responsible for the maintenance and security of the BAS and related networks and systems. In the event there is a service agreement between Trane and Customer, Trane will provide the services as set forth in the service agreement.

In order to maintain a minimum level of security for the BAS, associated networks, network equipment and systems, Customer's cybersecurity responsibilities include without limitation:

1. Ensure that the BAS, networks, and network equipment are physically secure and not accessible to unauthorized personnel.
2. Ensure the BAS remains behind a secure firewall and properly segmented from all other customer networks and systems, especially those with sensitive information.
3. Keep all Inbound ports closed to any IP Addresses in the BAS.
4. Remove all forwarded inbound ports and IP Addresses to the BAS.
5. Maintain user login credentials and unique passwords, including the use of strong passwords and the removal of access for users who no longer require access.
6. Where remote access is desired, utilize a secure method such as Trane Connect Secure Remote Access or your own VPN.
7. For any Trane services requiring remote data transfer and/or remote user access, configure the BAS and related firewall(s) per instructions provided by Trane. This typically includes configuring Port 443 and associated firewall(s) for Outbound only.
8. Perform regular system maintenance to ensure that your BAS is properly secured, including regular software updates to your BAS and related network equipment (i.e., firewalls).

Any and all claims, actions, losses, expenses, costs, damages, or liabilities of any nature due to Customer's failure to maintain BAS security responsibilities and/or industry standards for cybersecurity are the sole responsibility of the Customer.

1-26.251-10(1024)
Supersedes 1-26.251-10(0123)

SECURITY ADDENDUM

This Addendum shall be applicable to the sale, installation and use of Trane equipment and the sale and provision of Trane services. "Trane" shall mean Trane U.S. Inc. for sales and services in the United States, or Trane Canada ULC for sales and services in Canada.

1. **Definitions.** All terms used in this Addendum shall have the meaning specified in the Agreement unless otherwise defined herein. For the purposes of this Addendum, the following terms are defined as follows:

   "Customer Data" means Customer account information as related to the Services only and does not include HVAC Machine Data or personal data. Trane does not require, nor shall Customer provide personal data to Trane under the Agreement. Such data is not required for Trane to provide its Equipment and/or Services to the Customer.

   "Equipment" shall have the meaning set forth in the Agreement.

   "HVAC Machine Data" means data generated and collected from the product or furnished service without manual entry. HVAC Machine Data is data relating to the physical measurements and operating conditions of a HVAC system, such as but not limited to, temperatures, humidity, pressure, HVAC equipment status. HVAC Machine Data does not include Personal Data and, for the purposes of this agreement, the names of users of Trane's controls products or hosted applications shall not be Personal Data, if any such user chooses to use his/her name(s) in the created accounts within the controls product (e.g., firstname.lastname@address.com). HVAC Machine Data may be used by Trane: (a) to provide better support services and/or products to users of its products and services; (b) to assess compliance with Trane terms and conditions; (c) for statistical or other analysis of the collective characteristics and behaviors of product and services users; (d) to backup user and other data or information and/or provide remote support and/or restoration; (e) to provide or undertake: engineering analysis; failure analysis; warranty analysis; energy analysis; predictive analysis; service analysis; product usage analysis; and/or other desirable analysis, including, but not limited to, histories or trends of any of the foregoing; and (f) to otherwise understand and respond to the needs of users of the product or furnished service. "Personal Data" means data and/or information that is owned or controlled by Customer, and that names or identifies, or is about a natural person, such as: (i) data that is explicitly defined as a regulated category of data under any data privacy laws applicable to Customer; (ii) non-public personal information ("NPI") or personal information ("PI"), such as national identification number, passport number, social security number, social insurance number, or driver's license number; (iii) health or medical information, such as insurance information, medical prognosis, diagnosis information, or genetic information; (iv) financial information, such as a policy number, credit card number, and/or bank account number; (v) personally identifying technical information (whether transmitted or stored in cookies, devices, or otherwise), such as IP address, MAC address, device identifier, International Mobile Equipment Identifier ("IMEI"), or advertising identifier; (vi) biometric information; and/or (vii) sensitive personal data, such as, race, religion, marital status, disability, gender, sexual orientation, geolocation, or mother's maiden name.

   "Security Incident" shall refer to (i) a compromise of any network, system, application or data in which Customer Data has been accessed or acquired by an unauthorized third party; (ii) any situation where Trane reasonably suspects that such compromise may have occurred; or (iii) any actual or reasonably suspected unauthorized or illegal Processing, loss, use, disclosure or acquisition of or access to any Customer Data.

   "Services" shall have the meaning set forth in the Agreement.

2. HVAC Machine Data; Access to Customer Extranet and Third Party Systems. If Customer grants Trane access to HVAC Machine Data via web portals or other non-public websites or extranet services on Customer's or a third party's website or system (each, an "Extranet"), Trane will comply with the following:
   a. Accounts. Trane will ensure that Trane's personnel use only the Extranet account(s) designated by Customer and will require Trane personnel to keep their access credentials confidential.
   b. Systems. Trane will access the Extranet only through computing or processing systems or applications running operating systems managed by Trane that include: (i) system network firewalls; (ii) centralized patch management; (iii) operating system appropriate anti-malware software; and (iv) for portable devices, full disk encryption.
   c. Restrictions. Unless otherwise approved by Customer in writing, Trane will not download, mirror or permanently store any HVAC Machine Data from any Extranet on any medium, including any machines, devices or servers.
   d. Account Termination. Trane will terminate the account of each of Trane's personnel in accordance with Trane's standard practices after any specific Trane personnel who has been authorized to access any Extranet (1) no longer needs access to HVAC Machine Data or (2) no longer qualifies as Trane personnel (e.g., the individual leaves Trane's employment).
   e. Third Party Systems. Trane will provide Customer prior notice before it uses any third party system that stores or may otherwise have access to HVAC Machine Data, unless (1) the data is encrypted and (2) the third party system will not have access to the decryption key or unencrypted "plain text" versions of the HVAC Machine Data.

3. Customer Data; Confidentiality. Trane shall keep confidential, and shall not access or use any Customer Data and information that is marked confidential or by its nature is considered confidential ("Customer Confidential Information") other than for the purpose of providing the Equipment and Services, and will disclose Customer Confidential Information only: (i) to Trane's

employees and agents who have a need to know to perform the Services, (ii) as expressly permitted or instructed by Customer, or (iii) to the minimum extent required to comply with applicable law, provided that Trane (1) provides Customer with prompt written notice prior to any such disclosure, and (2) reasonably cooperate with Customer to limit or prevent such disclosure.

4. Customer Data; Compliance with Laws. Trane agrees to comply with laws, regulations governmental requirements and industry standards and practices relating to Trane's processing of Customer Confidential Information (collectively, "***Laws***").

5. Customer Data; Information Security Management. Trane agrees to establish and maintain an information security and privacy program, consistent with applicable HVAC equipment industry practices that complies with this Addendum and applicable Laws ("***Information Security Program***"). The Information Security Program shall include appropriate physical, technical and administrative safeguards, including any safeguards and controls agreed by the Parties in writing, sufficient to protect Customer systems, and Customer's Confidential Information from unauthorized access, destruction, use, modification or disclosure. The Information Security Program shall include appropriate, ongoing training and awareness programs designed to ensure that Trane's employees and agents, and others acting on Trane's, behalf are aware of and comply with the Information Security Program's policies, procedures, and protocols.

6. Monitoring. Trane shall monitor and, at regular intervals consistent with HVAC equipment industry practices, test and evaluate the effectiveness of its Information Security Program. Trane shall evaluate and promptly adjust its Information Security Program in light of the results of the testing and monitoring, any material changes to its operations or business arrangements, or any other facts or circumstances that Trane knows or reasonably should know may have a material impact on the security of Customer Confidential Information, Customer systems and Customer property.

7. Audits. Customer acknowledges and agrees that the Trane SOC2 audit report will be used to satisfy any and all audit/inspection requests/requirements by or on behalf of Customer. Trane will make its SOC2 audit report available to Customer upon request and with a signed nondisclosure agreement.

8. Information Security Contact. Trane's information security contact is Local Sales Office.

9. Security Incident Management. Trane shall notify Customer after the confirmation of a Security Incident that affects Customer Confidential Information, Customer systems and Customer property. The written notice shall summarize the nature and scope of the Security Incident and the corrective action already taken or planned.

10. Threat and Vulnerability Management. Trane regularly performs vulnerability scans and addresses detected vulnerabilities on a risk basis. Periodically, Trane engages third-parties to perform network vulnerability assessments and penetration testing. Vulnerabilities will be reported in accordance with Trane's cybersecurity vulnerability reported process. Trane periodically provides security updates and software upgrades.

11. Security Training and Awareness. New employees are required to complete security training as part of the new hire process and receive annual and targeted training (as needed and appropriate to their role) thereafter to help maintain compliance with Security Policies, as well as other corporate policies, such as the Trane Code of Conduct. This includes requiring Trane employees to annually re-acknowledge the Code of Conduct and other Trane policies as appropriate. Trane conducts periodic security awareness campaigns to educate personnel about their responsibilities and provide guidance to create and maintain a secure workplace.

12. Secure Disposal Policies. Trane will maintain policies, processes, and procedures regarding the disposal of tangible and intangible property containing Customer Confidential Information so that wherever possible, Customer Confidential Information cannot be practicably read or reconstructed.

13. Logical Access Controls. Trane employs internal monitoring and logging technology to help detect and prevent unauthorized access attempts to Trane's corporate networks and production systems. Trane's monitoring includes a review of changes affecting systems' handling authentication, authorization, and auditing, and privileged access to Trane production systems. Trane uses the principle of "least privilege" (meaning access denied unless specifically granted) for access to customer data.

14. Contingency Planning/Disaster Recovery. Trane will implement policies and procedures required to respond to an emergency or other occurrence (i.e. fire, vandalism, system failure, natural disaster) that could damage Customer Data or any system that contains Customer Data. Procedures include the following
    (i) Data backups; and
    (ii) Formal disaster recovery plan. Such disaster recovery plan is tested at least annually.

15. Return of Customer Data. If Trane is responsible for storing or receiving Customer Data, Trane shall, at Customer's sole discretion, deliver Customer Data to Customer in its preferred format within a commercially reasonable period of time following the expiration or earlier termination of the Agreement or, such earlier time as Customer requests, securely destroy or render unreadable or undecipherable each and every original and copy in every media of all Customer's Data in Trane's possession, custody or control no later than [90 days] after receipt of Customer's written instructions directing Trane to delete the Customer Data.

16. Background Checks Trane shall take reasonable steps to ensure the reliability of its employees or other personnel having access to the Customer Data, including the conducting of appropriate background and/or verification checks in accordance with Trane policies.

17. DISCLAIMER OF WARRANTIES. EXCEPT FOR ANY APPLICABLE WARRANTIES IN THE AGREEMENT, THE SERVICES ARE PROVIDED "AS IS", WITH ALL FAULTS, AND THE ENTIRE RISK AS TO SATISFACTORY QUALITY, PERFORMANCE, ACCURACY AND EFFORT AS TO SUCH SERVICES SHALL BE WITH CUSTOMER. TRANE DISCLAIMS ANY AND ALL OTHER EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES WITH RESPECT TO THE SERVICES AND THE SERVICES PROVIDED HEREUNDER, INCLUDING ANY EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR THAT THE SERVICES WILL OPERATE ERROR-FREE OR UNINTERRUPTED OR RETURN/RESPONSE TO INQUIRIES WITHIN ANY SPECIFIC PERIOD OF TIME.

October 2024
Supersedes: November 2023v2

Trane Omnia Equipment and Controls Scope

West Haverstraw Elementary School

Proposal Prepared For:
North Rockland Central School District
65 Chapel St
Garnerville, NY 10923

Local Trane Office:
Trane U.S. Inc.
19 Chapin Road, Bldg B, Suite 200
Pine Brook, NJ 07058

Omnia Contract Number:
B6-uZ0AAK-24-009

Date: February 24, 2025

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Prepared For: North Rockland CSD

Date: February 24, 2025

Job Name:
North Rockland CSD West Haverstraw ES
Univent Replacement

Proposal Number: B6-256536-37248-1
OMNIA-COOP: RACINE COUNTY#3341
Opportunity ID: 7965360

Delivery Terms:
Freight Allowed and Prepaid - F.O.B. Jobsite

Engineer: Greenman Pedersen Incorporated

Payment Terms: Net 30 Days

Trane U.S. Inc. is pleased to provide the following proposal for your review and approval.

This Scope of Work will be executed based on Trane's scope of work proposed herein, which is a clarification of the plans and specifications, and adheres to Trane's "Standard Contract Terms and Conditions" only; any other document and/or contract will not bind and/or supersede these conditions.

Building Automation System

This proposal has been developed from the following documentation:

- Plans and Specs prepared by: Greenman Pedersen, Inc
- Mechanical drawings WHES-M-003 through WHES-M-304 dated 05/10/24
- Electrical drawings WHES-E-061 through WHES-501 dated 05/10/24
- Specification sections 230923, 230924 & 230993
- Additional drawings reviewed: No additional documents provided to Trane at the time of this bid. All additional work as a result of these documents that is not listed below is not included from this bid.

Trane's pricing accounts for the following considerations:

- **Straight Time Labor**
- Trane's Electrical field installation will be performed by: **Union Electrical Contractor**
- Electrical Installation: Refer to Electrical Clarification section below
- **1 Year** parts and labor warranty against defects in material and workmanship on all new, Trane provided, field installed, DDC controllers and components.
- **24 Hours of Controls Technician Assistance for integration with the Siemens Building Management System.**
- **24 Hours of Commissioning Assistance of 3rd Party Commissioning Agent.**
- Project to be completed by **August 30, 2025**; escalation costs incurred after this date are not included and will be in addition to the Total Net Price(s) stated below. Added costs will depend upon the remaining scope identified at that time.

The following is Trane's scope of work:

1) TRANE BACNET GATEWAY EQUIPMENT:

a) **Trane will provide a BACnet gateway for integration into the existing Siemens Enterprise Level Building Management System. Siemens will be able to communicate with this system via BACnet/IP. Siemens will need to provide pricing to the district to integrate the new Trane system.**

b) Trane to setup operator interface for proper interaction with the BAS. User workstation interface will be:
   i) **Owner furnished or provided by Siemens**

c) **Graphics to be provided by Siemens.**

2) ASSOCIATED MECHANICAL EQUIPMENT:

a) **VRF System.** BAS will provide monitoring, control, and alarming of available points.
   i. Includes field installation of the following devices:
      a. CAT-6 Wiring to Centralized Controller. Trane will provide integration to the VRF Centralized Controller via BACnet/IP.
      b. Interlock to **(9)** Outdoor Air-Cooled Condensing Unit(s)

   ii. Low Voltage Daisy Chain Communication Wiring (16Ga TSP) to the following components:
      a. **(29)** Indoor Units
      b. **(9)** Branch Controllers
      c. **(51)** LEV Controllers

   iii. Wiring to the following components associated with **each** Indoor Unit:
      a. **(29 total)** Space Thermostat [Furnished by manuf.]
      b. **(26 total)** Condensate Pump [High Limit Switch Wiring Only]
      c. **(26 total)** DPLS2 Leak Detector [Furnished by manuf.]
      d. **(6 total)** Inline Booster Fans to associated indoor unit
         a. Requires installation of Relay Module

b) (51) Unit Ventilators (UV-X) with factory mounted DDC controllers. BAS will provide monitoring, control, and alarming of available points and field installation of the following devices:
   i. Room temperature sensor [wireless]
   ii. Return air temperature sensor
   iii. Outside air temperature sensor
   iv. Hot water control valve
   v. **(1 per UV)** LEV Controller with **115V:208V** Step UP Transformer
   vi. **(1 per UV)** LEVs Valves (On DX Coil)
   vii. **(4 per UV)** VRF sensors per LEV Control Box. Each sensor shall be wired back to the LEV Control Box. This includes:
      1) **(2 per UV)** Air Thermistors
      2) **(2 per UV)** Refrigerant sensors
   viii. Interlock between LEV Control Box & UV DDC Controller
   ix. Communication bus [wireless – Factory installed WCI]

c) (23) Exhaust fan (EF-x) control to include Start/Stop control and Status monitoring. To include the filed installation of (4) DDC Controllers, Field Installed WCI and Enclosures.

3) PROJECT SPECIFIC NOT INCLUDED:

a) Existing Building Management System checkout and testing. Testing, if required, must be provided by Siemens.
b) Graphics. Graphics will be provided by Siemens.
c) Upgrades to existing control systems.
d) All work associated with existing building equipment.
e) All work associated with any existing building management systems.
f) Integration into existing Building Management Systems. Work must be provided by Siemens, if required.
g) All work associated with existing pneumatics.
h) All work associated with demolition.
i) All work associated with the existing boiler plant. Boilers plant will operate as they are currently operating.

4) TRANE BUILDING AUTOMATION SYSTEM (BAS) CLARIFICATIONS:

a) **Project Management, Design Engineering, Field Engineering, and Operator Training Labor:**

i. Trane has included factory-trained BAS Project Management, Project Engineering, and Field Technician labor required to deliver a functional control system as qualified in this proposal. Mechanical startup in not included unless otherwise specified above.
ii. Trane to provide factory standard engineered control submittals including–product data sheets, and associated mechanical system sequence of operations. Any additional modifications or formatting that is not in the plans and specification are not included in this proposal.
iii. Project Management and field installation labor will be provided based upon project schedule and mechanical equipment field readiness.
iv. Trane has included an allowance, as stated above, for a field technician to assist the Balancing Contractor (BC) to connect their laptop for hydronic and air systems testing. This assistance includes helping the BC review the site, connect to the network and discover all devices. This assistance **DOES NOT** include a technician to work with the BC as they perform their work. The BC MUST possess their own laptop with a licensed copy of Trane balancing tool software. Contractor MUST provide Trane two weeks' notice for prior to scheduling. Trane will provide Time & Material billing based on published labor rates beyond the allotted allowance hours.
v. Trane to provide O&M manuals and as-built control submittal drawings upon completion of the project
vi. BAS Operator training allowance included as stated above. Additional training support hours are available on a T&M basis upon request. Training to be completed within (3) month of system acceptance.

b) **Electrical installation work clarifications:**

i. Trane has included 120 vac power wiring for **(0)** field mounted panels and electronic digital controllers in our scope of work. All other 120 vac end devices and panels are to be installed and wired by Division 26 Project Electrical Contractor, and **are not** included in this proposal.
ii. Trane is excluding power wiring of any kind (not listed above). Including but not limited to equipment, VAV boxes, DDC control panels and 120 vac control valve actuators
iii. BAS control wiring will be installed in EMT conduit in exposed mechanical spaces. For all other locations (i.e. ceilings and walls), wiring shall be installed with properly supported plenum rated cable outside of conduit.
iv. Outdoor control wiring shall be installed in galvanized rigid conduit or outdoor rated EMT that meets the National Electric Code requirements for the location of the project.
v. Trane has not included any labor associated with trenching required for underground conduits
vi. Trane electrical installation labor includes cleanup labor to ensure the work areas are clean of debris at the end of each working day. It has been assumed by Trane, the GC/CM for the project will be providing central collection areas for all project related debris.

c) **Warranty/Service Agreement**

i. Includes a one-year parts & labor warranty against defects in material & workmanship on all new, Trane provided, field-installed, DDC controllers and components. Warranty repair and replacement labor will occur during normal working hours.
ii. Warranty will end 18 months from shipment date or 12 months beginning with the date of beneficial use, whichever comes first.
iii. In the event of construction phasing of this project, each DDC system in a completed Phase will be warranted for 12 months, beginning with the date of beneficial use.
iv. BAS parts & labor warranty applies to field-installed controls only. Please refer to the equipment proposal for warranty coverage of the DDC controls factory supplied with the HVAC equipment.
v. Extended warranties are available upon specific requests
vi. Trane has not included an in-warranty service agreement within this proposal that includes Trane Intelligent Services, and/or Occupancy Adjustment visits to ensure proper operation during the warranty period described above.

d) **Clarifications:**

i. Trane is unable to release control submittals, order any materials or provide field labor until the tax determination for the project has been confirmed. If the project is exempt of taxes, Trane must be given appropriate state exempt forms at the onset of the project

ii. Trane will begin control submittals after the receipt of all approved Trane, non-Trane equipment submittals, and a detailed project schedule.
iii. Trane's BAS proposal and pricing is based upon Trane providing the HVAC equipment, with factory installed & tested controls, as described in this proposal. If non-Trane HVAC equipment is provided, Trane reserves the right to modify this proposal and subsequent pricing based upon the mechanical equipment being provided.
iv. Non-Trane systems being integrated to the BMS will come with the necessary material, labor and technical support to facilitate the integration to the BMS at no cost to Trane.
v. Trane has included our standard start-up and checkout labor practices for this project. Upon requiring coordination, documentation, and/or demonstration of systems performance to a designated Commissioning Agent Trane reserves the right to modify our pricing. A meeting is to be established to outline the method and documentation required for the commissioning work required.

e) **NOT Included:**

i. Providing, wiring, controlling or monitoring of any equipment/devices not included in the above scope
ii. Furnishing of PC or laptop computer for interface with BAS (refer to scope of work above).
iii. Electrical installation labor and material not included in the above scope.
iv. Interfacing to another BAS, to include any third party devices, software/hardware and any associated wiring and labor associated with integration
v. Startup, testing, troubleshooting or commissioning of equipment and devices not furnished by Trane. This includes miscellaneous control wiring provided by Trane for third party items
vi. Furnishing Variable Frequency Drives, starters, HOA switches, disconnects and/or associated electrical power wiring or integration.
vii. Installation of valves, dampers, pipe pressure taps, temperature sensor wells, pressure sensor/switch/transducer line sensor tubing and air flow measuring station
viii. Furnishing of control dampers
ix. Furnishing or installation of manufacturer supplied Boiler equipment, safeties, integral controls, gas train controls emergency shutoff switches, remote components and boiler circulating pumps control and associated wiring
x. Installation and furnishing of Boiler Safety Glass Shutdown and associated wiring
xi. Boiler combustion dampers, control and associated wiring
xii. Humidifier, Steam Generator, associated instruments, safety wiring and associated devices, utility piping, electrical power wiring, remote panel installation, or start-up labor
xiii. Stairwell pressurization control and any associated wiring
xiv. Air compressor and associated field devices with existing pneumatic system
xv. Sales Taxes
xvi. Alternate(s)/Add Alternate(s) are not included in the base scope
xvii. Fire, Smoke and/or Fire/Smoke dampers and any associated wiring
xviii. Exhaust Fans Dampers and associated wiring
xix. Smoke detectors; interface wiring with fire alarm system; smoke purge initiation
xx. Trenching required for underground conduit installation
xxi. Any cost associated with liquidated damages
xxii. Bid, Performance, or Payment Bonds
xxiii. Access doors
xxiv. Calibration certificates for any control devices
xxv. Demolition; excavation, roof penetrations; ceiling tile removal or replacement, cutting, patching and painting
xxvi. Checkout, repair, replacement or warranty of existing equipment
xxvii. Accelerated shipping costs
xxviii. Temporary, Standby or Overtime Labor; *All work figured to be done during normal working hours(7am to 3:30pm)*

Mechanical Equipment

Tag Data - VUVE Unit Ventilator (UV) (Qty: 51)

Item	Tag(s)	Qty	Description	Model Number
A1	UV-4, UV-12D, UV-24, UV-12A, UV-12C, UV-13B, UV-49B	7	VUVE Unit Ventilator (UV)	VUVE0750
A2	UV-1, UV-2, UV-3, UV-5, UV-6, UV-7, UV-8, UV-9, UV-10, UV-11, UV-12, UV-13, UV-14, UV-15, UV-16, UV-17, UV-18, UV-19, UV-20, UV-21, UV-22, UV-23, UV-25, UV-28, UV-30, UV-36, UV-44-1, UV-44-2, UV-45, UV-47, UV-49, UV-51, UV-61, UV-46-F-1, UV-46-F-2	35	VUVE Unit Ventilator (UV)	VUVE1500
A3	UV-26, UV-27, UV-29, UV-31, UV-32, UV-33, UV-34, UV-35, UV-37	9	VUVE Unit Ventilator (UV)	VUVE1250

Product Data - VUVE Unit Ventilator (UV)
All Units

Vertical unit ventilator
115v/60hz/1ph
Return air front/fresh air back
DX cooling with HW heating
ECM & Low FLA
Toggle disconnect switch
2-Way, Modulating
Discharge grille with wire mesh
Modulating outside air damper
Symbio 400-B with Air-Fi WCI
Wireless sensor
Digital display
21.25" depth with full sheetmetal back
21.25" deep end covers
Insulated front panel
Deluxe Piping Package
Auxiliary drain pan
Throwaway filter (A1-750 CFM ONLY)
MERV 13 FILTER (A2, A3 ONLY)
Startup and Warranty by NJ Trane Service

NOT Included: Smoke detectors, crossover piping, wall sleeves, wall boxes, recessing flange, shelving, external vibration isolation, rigging/receiving, subbases, spare parts.

Tag Data - 18 inch piping cabinet (Qty: 51)

Item	Tag(s)	Qty	Description	Model Number
B1	18 inch	51	**18 inch piping cabinet**	SHLB5700

Product Data - Unit Ventilator Shelving Units
Item: B1 Qty: 51 Tag(s): 18 inch piping cabinet

Classroom shelving (Field Installed by contractor)
21.25" [540mm] deep piping compartment
Louver Front Kickplate (no side) (Field Installed by contractor)

NOT Included: Top panel, rigging/receiving, spare parts and startup/service/warranty labor.

Tag Data - Linear Expansion Valve Kit (Qty: 51)

Item	Tag(s)	Qty	Description
C1	UV-14, UV-15, UV-16, UV-17, UV-18, UV-19, UV-20, UV-21, UV-22, UV-23, UV-25, UV-1, UV-2, UV-3, UV-5, UV-6, UV-7, UV-8, UV-9, UV-10, UV-11, UV-12, UV-13, UV-46F-1, UV-46F-2, UV-26, UV-28, UV-30, UV-32, UV-34, UV-36, UV-44-2, UV-27, UV-29, UV-31, UV-33, UV-35, UV-37, UV-44-1, UV-45, UV-47, UV-49, UV-51, UV-61	44	Linear Expansion Valve Kit (JV_LEV)
C2	UV-24, UV-4, UV-13B, UV-12A, UV-12C, UV-O-12, UV-51A	7	Linear Expansion Valve Kit (JV_LEV)

Product Data - Linear Expansion Valve Kit
All Units
1 PAC-AH001-1 LEV Controller

Item: C1 Qty: 44 Tag(s): UV-14, UV-15, UV-16, UV-17, UV-18, UV-19, UV-20, UV-21, UV-22, UV-23, UV-25, UV-1, UV-2, UV-3, UV-5, UV-6, UV-7, UV-8, UV-9, UV-10, UV-11, UV-12, UV-13, UV-46F-1, UV-46F-2, UV-26, UV-28, UV-30, UV-32, UV-34, UV-36, UV-44-2, UV-27, UV-29, UV-31, UV-33, UV-35, UV-37, UV-44-1, UV-45, UV-47, UV-49, UV-51, UV-61
1 PAC-LV48AC-1

Item: C2 Qty: 7 Tag(s): UV-24, UV-4, UV-13B, UV-12A, UV-12C, UV-O-12, UV-51A
1 PAC-LV24AC-1

Tag Data - VRF Indoor Unit (Qty: 29)

Item	Tag(s)	Qty	Description
D1	CC-1A, CC-38, CC-39, CC-50, CC-55, CC-61A, CC-61B	7	VRF Indoor Unit (JV_IDU)
D2	AHU-60, AHU-58, AHU-59, AHU-61, AHU-56, AHU-57, AHU-46G, AHU-46H, AHU-48, AHU-52, AHU-52B, AHU-46, AHU-55E, AHU-54E, AHU-53, AHU-53A	16	VRF Indoor Unit (JV_IDU)
D3	CC-44-1, CC-44-2, CC-43-1, CC-43-2	4	VRF Indoor Unit (JV_IDU)
D4	OA Unit 1, OA Unit 2	2	VRF Indoor Unit (JV_IDU)

Product Data - VRF Indoor Unit
All Units
1 TAR-41 Programmable Thermostat (Field Installed by contractor)

Item: D1 Qty: 7 Tag(s): CC-1A, CC-38, CC-39, CC-50, CC-55, CC-61A, CC-61B
TPLFYP006EM142A 4-way Ceiling Cassette Indoor Unit
1 PAC-SH59KF-E High Eff Filter Element (Field Installed by contractor)
1 PAC-SJ41TM-E-MULTI-FUNCTION CASEMENT (Field Installed by contractor)
1 TLP-41EAEU-GRILL FOR TPLFY-EP & TPLA-7 INDOOR (Field Installed by contractor)

Item: D2 Qty: 16 Tag(s): AHU-60, AHU-58, AHU-59, AHU-61, AHU-56, AHU-57, AHU-46G, AHU-46H, AHU-48, AHU-52, AHU-52B, AHU-46, AHU-55E, AHU-54E, AHU-53, AHU-53A
TPKFYP004LM140B Wall Mounted Indoor Unit
1 GOBI-II-REFCO PUMP 100-240 VAC 50/6O Hz (Field Installed by contractor)

Item: D3 Qty: 4 Tag(s): CC-44-1, CC-44-2, CC-43-1, CC-43-2
TPLFYP012EM140B 4-way Ceiling Cassette Indoor Unit
1 PAC-SH59KF-E High Eff Filter Element (Field Installed by contractor)
1 PAC-SJ41TM-E-MULTI-FUNCTION CASEMENT (Field Installed by contractor)
1 TLP-41EAEU-GRILL FOR TPLFY-EP & TPLA-7 INDOOR (Field Installed by contractor)

Item: D4 Qty: 2 Tag(s): OA Unit 1, OA Unit 2
TPEFYP036OA140A Ceiling Concealed Ducted Indoor Unit

Tag Data - VRF Outdoor Unit (Qty: 9)

Item	Tag(s)	Qty	Description
E1	ACCU-1A, ACCU-1B, ACCU-3A, ACCU-3	4	VRF Outdoor Unit (JV_ODU)
E2	ACCU-2, ACCU-6	2	VRF Outdoor Unit (JV_ODU)
E3	ACCU-4, ACCU-5	2	VRF Outdoor Unit (JV_ODU)
E4	ACCU-7	1	VRF Outdoor Unit (JV_ODU)

Product Data - VRF Outdoor Unit

Item: E1 Qty: 4 Tag(s): ACCU-1A, ACCU-1B, ACCU-3A, ACCU-3

TURYE2163BN41AN – Outdoor System

- TURYE1203AN40AN MODULE#1 Outdoor Unit
- TURYE0963AN41AN MODULE#2 Outdoor Unit

Item: E2 Qty: 2 Tag(s): ACCU-2, ACCU-6

TURYE2883BN41AN – Outdoor System

- TURYE1443AN41AN MODULE#1 Outdoor Unit
- TURYE1443AN41AN MODULE#2 Outdoor Unit

Item: E3 Qty: 2 Tag(s): ACCU-4, ACCU-5

TURYE2403BN41AN – Outdoor System

- TURYE1203AN40AN MODULE#1 Outdoor Unit
- TURYE1203AN41AN MODULE#2 Outdoor Unit

Item: E4 Qty: 1 Tag(s): ACCU-7

TUHYE072A3AN41AN – Outdoor System

- TUHYE0723AN41AN MODULE#1 Outdoor Unit

Tag Data - VRF Accessory (Qty: 1)

Item	Tag(s)	Qty	Description
F1	VRF Accessory	1	VRF Accessory (JV_ACC)

Product Data - VRF Accessory

Item: F1 Qty: 1 Tag(s): VRF Accessory

6 CMY-R200NCBK-TWINNING KIT (R2 EP/P192 TO 240 T/YSNU) (Field Installed by contractor)
2 CMY-R300NCBK-TWINNING KIT (R2 EP/P264 TO 336 T/YSNU) (Field Installed by contractor)
7 CMY-R302S-G1-REDUCER JA1 TYPE BC CONTROLLER (Field Installed by contractor)
1 CMY-R304S-G1-REDUCER KA1 TYPE BC CONTROLLER (Field Installed by contractor)
1 CMY-R305S-G1-REDUCER KA1 TYPE BC CONTROLLER WITH SUB (Field Installed by contractor)
1 CMY-R306S-G-REDUCER KB1 TYPE BC CONTROLLER (Field Installed by contractor)
96 BV38BBSI-3/8" BALL VALVE, BRAZED (Field Installed by contractor)
96 BV58BBSI-5/8" BALL VALVE, BRAZED (Field Installed by contractor)
1 WDN-1-Front and Rear Wind Deflectors for SM/XL units (Field Installed by contractor)
32 WDN-2-Front and Rear Wind Deflectors for LG units (Field Installed by contractor)
9 SWDN-1-Side Wind Deflectors (Field Installed by contractor)
1 CMY-Y102LS-G2-CITY MULTI- BRANCH PIPE (Field Installed by contractor)
2 CMY-Y102SS-G2-BRANCH PIPE (Field Installed by contractor)
16 LAHN-3-Low Ambient Hood Assembly (master) for LG units (Field Installed by contractor)
16 LAHN-4-Low Ambient Hood Assembly (subordinate) for LG units (Field Installed by contractor)
1 LAHN-1-Low Ambient Hood Assembly (master) for SM/XL units (Field Installed by contractor)

Tag Data - VRF Branch Controller (Qty: 9)

Item	Tag(s)	Qty	Description
G1	VRF Branch Co	9	VRF Branch Controller (JV_BCU)

Product Data - VRF Branch Controller
Item: G1 Qty: 9 Tag(s): VRF Branch Controller

2 Accessory 12 Branch Main BC (Field Installed by contractor)
1 Accessory 4 Branch Sub BC (Field Installed by contractor)
1 Accessory 16 Branch Main BC (Field Installed by contractor)
4 TCMBM0108JA21N4 (Field Installed by contractor)
1 TCMBM1012JA21N4 (Field Installed by contractor)

Tag Data - VRF Controls (Qty: 1)

Item	Tag(s)	Qty	Description
H1	VRF Controls	1	VRF Controls (JV_CTRL)

Product Data - VRF Controls
Item: H1 Qty: 1 Tag(s): VRF Controls

2 TAR-30MAOA-J (Field Installed by contractor)
1 LIC-BACNET EXPANSION
1 LIC-BACNET MASTER
1 TE-200A Centralized Controller (Field Installed by contractor)
1 TE-50A Expansion (Field Installed by contractor)

Proposal Clarifications and Exclusions:

- Proposal above does not include rigging and receiving of equipment. North Rockland CSD is responsible for receiving and unloading equipment.
- Proposal above does not include storage of equipment.
- Proposal above does not include extended warranties or delayed startup.
- Proposal above does not include stands, springs, rails, or pads for the VRF outdoor condensing units.
- Proposal above does not include shelving of any kind for the unit ventilators.
- Proposal above does not include VRF line sets. Refrigerant Piping is by the Installing Contractor.
- Proposal above does not include spare filters.
- Confirm Unit Ventilator Heating Control valve is 2 way or 3 ways prior to release.
- Confirm low FLA option for unit ventilators prior to release.
- Confirm if subbases are required on all unit ventilators prior to releasing.
- Confirm schedule of VRF ODUs is incorrect. Trane's proposal is based on the floor plans and refrigerant piping diagrams, to include a total of [9] ODUs.
- Installation of all equipment is to be provided by others.
- Installing contractor is responsible for procuring and installing booster fans for the cassettes that are pulling fresh air directly from outside air louvers and are not served by other equipment. Power to the booster fans shall be provided by the Div 26 Electrical Contractor.
- Please refer to the complete scope for additional exclusions per product type.
- Graphics shall be provided by Siemens.
- Integration into the Siemens Building Management System shall be provided by Siemens. This work is not included in the Trane scope of work. A separate quote from Siemens will be required for this work.

Installation Responsibilities:

1) **The Installing Mechanical Contractor** is responsible for the removal of any existing DX valves factory-installed on-unit ventilator.
2) **The Installing Mechanical Contractor** is responsible for brazing of the Mitsubishi VRF LEV valve assemblies to the unit ventilator.
3) **Trane Controls** is responsible for field mounting of the Linear Expansion Valve Control Boxes.
4) **Trane Controls** is responsible for field installation of qty (4) VRF sensors for each LEV Control Box. This includes (2) air thermistors and (2) refrigerant sensors and wiring back to Linear Expansion Valve Control Boxes.

5) **Trane Controls** is responsible for wire interlock between LEV controller and LEV valve assemblies
6) **Trane Controls** is responsible for wire interlock between LEV controller and UC controller, and UC Controller to wall thermostat (if applicable).
7) **Trane Controls** is responsible for all M-net wiring.
8) **The Licensed Electrical Contractor** is responsible for bringing 208-230V power to the LEV Controller, in addition to the Unit Ventilator power.
9) **Trane Controls** is responsible for programming of UC Controller (if applicable).
10) **Trane Controls** is responsible for any interlock of 3rd party devices with UC Controller (if applicable)
11) **Trane Service** is responsible for the start-up of the traditional air handling device.
12) **The Installing Mechanical Contractor** is responsible for the start-up of the VRF components.
13) **Trane Controls** is responsible for the addressing of the VRF system
14) **The Installing Mechanical Contractor** is responsible for providing and installing unit ventilator condensate pumps.
15) **The Licensed Electrical Contractor** is responsible for providing power to condensate pumps, when required.

Not Included: Control integration/wiring, smoke detectors, refrigeration tees, filter boxes, wind baffles(unless otherwise noted), hail/snow guards, flow switches, secondary drain pans, secondary condensate overflow sensors, external condensate pumps (unless otherwise noted), disconnects, refrigerant piping specialties, hangers, refrigerant piping, water piping, hose kits/valves, insulation, isolation valves, watt-hour meters, tenant billing software, additional refrigerant, roof rails or curbs, condensing unit mounting brackets, humidity sensors, external vibration isolation, rigging/receiving, addressing, rotary dials, dipswitches, spare parts, service labor, installation labor, LEV installation, LEV sensor installation, extended warranty.

Ductless Warranty/Technical Installation Support

A. Site Review by Ductless Technical Specialist
   1. Pre-construction meeting with Trane Ductless Technical Specialist required to review site conditions, installation requirements, best practices, and pre-startup requirements.
   2. At least (1) jobsite review during installation with Trane Ductless Technical Specialist required.
   3. If it is found that the refrigerant pipe lengths on the submittal diagrams must be significantly modified to achieve installation in the field, the installing Contractor must provide updated estimated piping layout prior to installation of pipe.
   4. Installing Contractor must provide updated as-built piping layout required to complete the Diamond System Builder design file prior to start-up.
   5. **Owner-Training by Trane Service Department is not included unless otherwise noted.**

B. VRF City-Multi Start-Up Assistance by Ductless Technical Specialist
   1. **No start-up assistance included on Nv&P-Series Mini-Splits unless otherwise noted.**
   2. Trane can provide a Ductless Technical Specialist to supervise the start-up of up to 2 systems.
   3. Installing Contractor MUST have technicians on-site to perform mechanical start-up under the supervision of Trane. Technician must be equipped with Maintenance Tool and a Laptop.
   4. Installing Contractor must contact Ductless Technical Specialist to schedule VRF Assisted Start-Up no less than 2 weeks before requested start-up date.
   5. Installing contractor must submit completed Component Location Sheet and Prestart Checklist to Ductless Technical Specialist no later than 3-days prior to requested start-up date.
   6. Installing Contractor must verify system installations meet Trane-Mitsubishi requirements including but not limited to service clearances, pressure tests, vacuum tests, electrical power to units, wiring/piping connections, and refrigerant charge prior to start-up.
   7. No installation labor will be completed by Trane personnel unless otherwise noted.
   8. City Multi and Nv&P-Series Service/Maintenance Tools not included unless otherwise noted.
   9. Any additional labor required from Trane to complete start-up procedure will be billed separately.

   Responsibilities of DTS at Assisted Start-Up:
      1. Provide support to installing contractor as system start-up data is pulled into Maintenance Tool
      2. Population of TE-200/TW-50 if applicable (any integration and programming by others)

   Responsibilities of Installing Contractor at Assisted Start-Up:
      1. Electrical Testing on outdoor units
      2. Physical inspection of the outdoor units

3. Troubleshoot indoor units if there is an issue
4. Handling of additional refrigerant and adding of trim charge
5. **Setting addresses, dipswitches, and rotary dials on the Indoor units, Outdoor units, Controllers, and Branch Controllers.**
6. Performing of vacuum and pressure tests

C. Warranty
1. VRF City-Multi Standard Warranty is 1 year parts, 7 year compressor from the time of startup. VRF City-Multi Extended 10-Year Parts/Compressor Warranty will be applied if the following requirements are met:
    a. Installing Contractor completes a certified Trane-Mitsubishi 3-day City-Multi Installation/Service Course, and documents attendees and date of completion.
    b. The system is designed by a certified Diamond Designer using Diamond System Builder™
    c. The contractor generates a complete and approved METUS Extended Warranty Process Report from the Diamond System Builder software.

    (See Trane-Mitsubishi Warranty Policy for details.)
2. **Installing Contractor is responsible for completion of Diamond System Builder warranty filing and final submission to METUS Extended Warranty Department.**
3. Nv&P Series Standard Warranty is 5 year parts, 7 year compressor from the time of startup. Nv&P Series Extended 10-Year Parts/Compressor Warranty will be applied if the product is installed in a residential application and registered within 90 days of installation. See Nv-Series and P-Series Limited Warranty Policies for details.
4. No labor warranty is included here unless otherwise noted. Please contact your Trane Account Manager for availability.

Supplementary Guidelines

A. Purchasing Contractor and/or Consulting Engineer must validate unit voltages, model numbers, quantities, required accessories, and unit configurations prior to order.
B. Consulting Engineer/Architect and Installing Contractor must approve equipment submittals and system design prior to order, including but not limited to all code/standard compliances, system application (heat pump vs. heat recovery), service clearances, refrigerant concentration compliance, load analysis, unit configuration, and installation requirements.
C. Outdoor condensing units must be installed on stands at a minimum height of 12”. Ground installation or raised pads are not acceptable.
D. Insulation is required on all condensate piping and refrigerant piping including liquid lines, low pressure gas lines, and high pressure gas lines.
E. All M-Net Control Wiring must be 16AWG, 2-conductor, stranded, shielded cable (MA controllers allow 22-16AWG wire)
F. All BC-Controllers must have condensate drain line installed.
G. All Linear Expansion Valve kits require 208V/1ph power.
H. Additional units/accessories not included in the scope will be at an additional cost.
I. All TQ*YP Water Source units require a **field-supplied** flow switch and strainer. Water quality must be adequately maintained. See the METUS installation manual for full details.

Disclaimer:

To protect our climate and reduce emissions from hydrofluorocarbons (HFCs), the American Innovation & Manufacturing (AIM) Act directs the U.S. Environmental Protection Agency (EPA) to phase down the supply of HFCs. This proposal includes Mitsubishi Electric Trane HVAC Mini Split heat pump products that must comply with the AIM Act by transitioning to a next-generation refrigerants with less than 700 GWP, R-454B has a global warming potential of 466 and will replace the proposed R-410A mini split systems quoted on this project when R-410A unit inventory is depleted. The AIM act mandates that manufacturers must discontinue manufacturing R-410A mini split heat pumps by December 31st 2024 and discontinue selling them by December 31st 2025. As such, Trane will begin to phase down the sale and distribution of R-410A mini splits in the 2025 calendar year and transition to R-454B mini splits when R-410A unit inventory is depleted. The above proposal includes R-410A product that will be subject to this transition. This pricing is only valid for the items listed on the proposal and is only valid until R-410A unit inventory is depleted. At such time, this proposal will need to be updated to include R-454B units. Please contact your Trane field Sales Representative for an updated quote/budget.

TERMS AND CONDITIONS – COMMERCIAL INSTALLATION

"Company" shall mean Trane U.S. Inc. for Work performed in the United States or Trane Canada ULC for Work performed in Canada.

1. Acceptance; Agreement. These terms and conditions are an integral part of Company's offer and form the basis of any agreement (the "Agreement") resulting from Company's proposal (the "Proposal") for the commercial goods and/or services described (the "Work"). COMPANY'S TERMS AND CONDITIONS AND EQUIPMENT PRICES ARE SUBJECT TO PERIODIC CHANGE OR AMENDMENT. The Proposal is subject to acceptance in writing by the party to whom this offer is made or an authorized agent ("Customer") delivered to Company within 30 days from the date of the Proposal. Prices in the Proposal are subject to change at any time upon notice to Customer. If Customer accepts the Proposal by placing an order, without the addition of any other terms and conditions of sale or any other modification, Customer's order shall be deemed acceptance of the Proposal subject to Company's terms and conditions. If Customer's order is expressly conditioned upon Company's acceptance or assent to terms and/or conditions other than those expressed herein, return of such order by Company with Company's terms and conditions attached or referenced serves as Company's notice of objection to Customer's terms and as Company's counteroffer to provide Work in accordance with the Proposal and the Company terms and conditions. If Customer does not reject or object in writing to Company within 10 days, Company's counteroffer will be deemed accepted. Notwithstanding anything to the contrary herein, Customer's acceptance of the Work by Company will in any event constitute an acceptance by Customer of Company's terms and conditions. This Agreement is subject to credit approval by Company. Upon disapproval of credit, Company may delay or suspend performance or, at its option, renegotiate prices and/or terms and conditions with Customer. If Company and Customer are unable to agree on such revisions, this Agreement shall be cancelled without any liability, other than Customer's obligation to pay for Work rendered by Company to the date of cancellation.

2. Connected Services. In addition to these terms and conditions, the Connected Services Terms of Service ("Connected Services Terms"), available at https://www.trane.com/TraneConnectedServicesTerms, as updated from time to time, are incorporated herein by reference and shall apply to the extent that Company provides Customer with Connected Services, as defined in the Connected Services Terms.

3. Title and Risk of Loss. All Equipment sales with destinations to Canada or the U.S. shall be made as follows: FOB Company's U.S. manufacturing facility or warehouse (full freight allowed). Title and risk of loss or damage to Equipment will pass to Customer upon tender of delivery of such to carrier at Company's U.S. manufacturing facility or warehouse.

4. Pricing and Taxes. Unless otherwise noted, the price in the Proposal includes standard ground transportation and, if required by law, all sales, consumer, use and similar taxes legally enacted as of the date hereof for equipment and material installed by Company. Tax exemption is contingent upon Customer furnishing appropriate certificates evidencing Customer's tax-exempt status. Company shall charge Customer additional costs for bonds agreed to be provided. Equipment sold on an uninstalled basis and any taxable labor/labour do not include sales tax and taxes will be added. Within thirty (30) days following Customer acceptance of the Proposal without addition of any other terms and conditions of sale or any modification, Customer shall provide notification of release for immediate production at Company's factory. Prices for Work are subject to change at any time prior to shipment to reflect any cost increases related to the manufacture, supply, and shipping of goods. This includes, but is not limited to, cost increases in raw materials, supplier components, labor, utilities, freight, logistics, wages and benefits, regulatory compliance, or any other event beyond Company's control. If such release is not received within 6 months after date of order receipt, Company reserves the right to cancel any order. If shipment is delayed due to Customer's actions, Company may also charge Customer storage fees. Company shall be entitled to equitable adjustments in the contract price to reflect any cost increases as set forth above and will provide notice to Customer prior to the date for which the increased price is to be in effect for the applicable customer contract. In no event will prices be decreased.

5. Exclusions from Work. Company's obligation is limited to the Work as defined and does not include any modifications to the Work site under the Americans With Disabilities Act or any other law or building code(s). In no event shall Company be required to perform work Company reasonably believes is outside of the defined Work without a written change order signed by Customer and Company.

6. Performance. Company shall perform the Work in accordance with industry standards generally applicable in the area under similar circumstances as of the time Company performs the Work. Company may refuse to perform any Work where working conditions could endanger property or put at risk the safety of persons. Unless otherwise agreed to by Customer and Company, at Customer's expense and before the Work begins, Customer will provide any necessary access platforms, catwalks to safely perform the Work in compliance with OSHA or state industrial safety regulations.

7. Payment. Customer shall pay Company's invoices within net 30 days of invoice date. Company may invoice Customer for all equipment or material furnished, whether delivered to the installation site or to an off-site storage facility and for all Work performed on-site or off-site. No retention shall be withheld from any payments except as expressly agreed in writing by Company, in which case retention shall be reduced per the contract documents and released no later than the date of substantial completion. Under no circumstances shall any retention be withheld for the equipment portion of the order. If payment is not received as required, Company may suspend performance and the time for completion shall be extended for a reasonable period of time not less than the period of suspension. Customer shall be liable to Company for all reasonable shutdown, standby and start-up costs as a result of the suspension. Company reserves the right to add to any account outstanding for more than 30 days a service charge equal to 1.5% of the principal amount due at the end of each month. Customer shall pay all costs (including attorneys' fees) incurred by Company in attempting to collect amounts due and otherwise enforcing these terms and conditions. If requested, Company will provide appropriate lien waivers upon receipt of payment. Customer agrees that, unless Customer makes payment in advance, Company will have a purchase money security interest in all equipment from Company to secure payment in full of all amounts due Company and its order for the equipment, together with these terms and conditions, form a security agreement. Customer shall keep the equipment free of all taxes and encumbrances, shall not remove the equipment from its original installation point and shall not assign or transfer any interest in the equipment until all payments due Company have been made.

8. Time for Completion. Except to the extent otherwise expressly agreed in writing signed by an authorized representative of Company, all dates provided by Company or its representatives for commencement, progress or completion are estimates only. While Company shall use commercially reasonable efforts to meet such estimated dates, Company shall not be responsible for any damages for its failure to do so. Delivery dates are approximate and not guaranteed. Company will use commercially reasonable efforts to deliver the Equipment on or before the estimated delivery date, will notify Customer if the estimated delivery dates cannot be honored, and will deliver the Equipment and services as soon as practicable thereafter. In no event will Company be liable for any damages or expenses caused by delays in delivery.

9. Access. Company and its subcontractors shall be provided access to the Work site during regular business hours, or such other hours as may be requested by Company and acceptable to the Work site' owner or tenant for the performance of the Work, including sufficient areas for staging, mobilization, and storage. Company's access to correct any emergency condition shall not be restricted. Customer grants to Company the right to remotely connect (via phone modem, internet or other agreed upon means) to Customer's building automation system (BAS) and or HVAC equipment to view, extract, or otherwise collect and retain data from the BAS, HVAC equipment, or other building systems, and to diagnose and remotely make repairs at Customer's request.

10. Completion. Notwithstanding any other term or condition herein, when Company informs Customer that the Work has been completed, Customer shall inspect the Work in the presence of Company's representative, and Customer shall either (a) accept the Work in its entirety in writing, or (b) accept the Work in part and specifically identify, in writing, any exception items. Customer agrees to re-inspect any and all excepted items as soon as Company informs Customer that all such excepted items have been completed. The initial acceptance inspection shall take place within ten (10) days from the date when Company informs Customer that the Work has been completed. Any subsequent re-inspection of excepted items shall take place within five (5) days from the date when Company informs Customer that the excepted items have been completed. Customer's failure to cooperate and complete any of said inspections within the required time limits shall constitute complete acceptance of the Work as of ten (10) days from date when Company informs Customer that the Work, or the excepted items, if applicable, has/have been completed.

11. Permits and Governmental Fees. Company shall secure (with Customer's assistance) and pay for building and other permits and governmental fees, licenses, and inspections necessary for proper performance and completion of the Work which are legally required when bids from Company's subcontractors are received, negotiations thereon concluded, or the effective date of a relevant Change Order, whichever is later. Customer is responsible for necessary approvals, easements, assessments and charges for construction, use or occupancy of permanent structures or for permanent changes to existing facilities. If the cost of such permits, fees, licenses and inspections are not included in the Proposal, Company will invoice Customer for such costs.

12. Utilities During Construction. Customer shall provide without charge to Company all water, heat, and utilities required for performance of the Work.

13. Concealed or Unknown Conditions. In the performance of the Work, if Company encounters conditions at the Work site that are (i) subsurface or otherwise concealed physical conditions that differ materially from those indicated on drawings expressly incorporated herein or (ii) unknown physical conditions of an unusual nature that differ materially from those conditions ordinarily found to exist and generally recognized as inherent in construction activities of the type and character as the Work, Company shall notify Customer of such conditions promptly, prior to significantly disturbing same. If such conditions differ materially and cause an increase in Company's cost of, or time required for, performance of any part of the Work, Company shall be entitled to, and Customer shall consent by Change Order to, an equitable adjustment in the Contract Price, contract time, or both.

14. Pre-Existing Conditions. Company is not liable for any claims, damages, losses, or expenses, arising from or related to conditions that existed in, on, or upon the Work site before the Commencement Date of this Agreement ("Pre-Existing Conditions"), including, without limitation, damages, losses, or expenses involving Pre-Existing Conditions of building envelope issues, mechanical issues, plumbing issues, and/or indoor air quality issues involving mold/mould and/or fungi. Company also is not liable for any claims, damages, losses, or expenses, arising from or related to work done by or services provided by individuals or entities that are not employed by or hired by Company.

15. Asbestos and Hazardous Materials. Company's Work and other services in connection with this Agreement expressly excludes any identification, abatement, cleanup, control, disposal, removal or other work connected with asbestos, polychlorinated biphenyl ("PCB"), or other hazardous materials (hereinafter, collectively, "Hazardous Materials"). Customer warrants and represents that, except as set forth in a writing signed by Company, there are no Hazardous Materials on the Work site

that will in any way affect Company's Work and Customer has disclosed to Company the existence and location of any Hazardous Materials in all areas within which Company will be performing the Work. Should Company become aware of or suspect the presence of Hazardous Materials, Company may immediately stop work in the affected area and shall notify Customer. Customer will be exclusively responsible for taking any and all action necessary to correct the condition in accordance with all applicable laws and regulations. Customer shall be exclusively responsible for and, to the fullest extent permitted by law, shall indemnify and hold harmless Company (including its employees, agents and subcontractors) from and against any loss, claim, liability, fees, penalties, injury (including death) or liability of any nature, and the payment thereof arising out of or relating to any Hazardous Materials on or about the Work site, not brought onto the Work site by Company. Company shall be required to resume performance of the Work in the affected area only in the absence of Hazardous Materials or when the affected area has been rendered harmless. In no event shall Company be obligated to transport or handle Hazardous Materials, provide any notices to any governmental agency, or examine the Work site for the presence of Hazardous Materials.

16. Force Majeure. Company's duty to perform under this Agreement is contingent upon the non-occurrence of an Event of Force Majeure. If Company shall be unable to carry out any material obligation under this Agreement due to an Event of Force Majeure, this Agreement shall at Company's election (i) remain in effect but Company's obligations shall be suspended until the uncontrollable event terminates or (ii) be terminated upon 10 days' notice to Customer, in which event Customer shall pay Company for all parts of the Work furnished to the date of termination. An "Event of Force Majeure" shall mean any cause or event beyond the control of Company. Without limiting the foregoing, "Event of Force Majeure" includes: acts of God; acts of terrorism, war or the public enemy; flood; earthquake; tornado; storm; fire; civil disobedience; pandemic insurrections; riots; labor/labour disputes; labor/labour or material shortages; sabotage; restraint by court order or public authority (whether valid or invalid), and action or non-action by or inability to obtain or keep in force the necessary governmental authorizations, permits, licenses, certificates or approvals if not caused by Company; and the requirements of any applicable government in any manner that diverts either the material or the finished product to the direct or indirect benefit of the government.

17. Customer's Breach. Each of the following events or conditions shall constitute a breach by Customer and shall give Company the right, without an election of remedies, to terminate this Agreement or suspend performance by delivery of written notice: (1) Any failure by Customer to pay amounts when due; or (2) any general assignment by Customer for the benefit of its creditors, or if Customer becomes bankrupt or insolvent or takes the benefit of any statute for bankrupt or insolvent debtors, or makes or proposes to make any proposal or arrangement with creditors, or if any steps are taken for the winding up or other termination of Customer or the liquidation of its assets, or if a trustee, receiver, or similar person is appointed over any of the assets or interests of Customer; (3) Any representation or warranty furnished by Customer in this Agreement is false or misleading in any material respect when made; or (4) Any failure by Customer to perform or comply with any material provision of this Agreement. Customer shall be liable to Company for all Work furnished to date and all damages sustained by Company (including lost profit and overhead)

18. Indemnity. To the fullest extent permitted by law, Company and Customer shall indemnify, defend and hold harmless each other from any and all claims, actions, costs, expenses, damages and liabilities, including reasonable attorneys' fees, resulting from death or bodily injury or damage to real or tangible personal property, to the extent caused by the negligence or misconduct of their respective employees or other authorized agents in connection with their activities within the scope of this Agreement. Neither party shall indemnify the other against claims, damages, expenses or liabilities to the extent attributable to the acts or omissions of the other party. If the parties are both at fault, the obligation to indemnify shall be proportional to their relative fault. The duty to indemnify will continue in full force and effect, notwithstanding the expiration or early termination hereof, with respect to any claims based on facts or conditions that occurred prior to expiration or termination.

19. Limitation of Liability. NOTWITHSTANDING ANYTHING TO THE CONTRARY, IN NO EVENT SHALL COMPANY BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT CONSEQUENTIAL, OR PUNITIVE OR EXEMPLARY DAMAGES (INCLUDING WITHOUT LIMITATION BUSINESS INTERRUPTION, LOST DATA, LOST REVENUE, LOST PROFITS, LOST DOLLAR SAVINGS, OR LOST ENERGY USE SAVINGS, INCLUDING CONTAMINANTS LIABILITIES, EVEN IF A PARTY HAS BEEN ADVISED OF SUCH POSSIBLE DAMAGES OR IF SAME WERE REASONABLY FORESEEABLE AND REGARDLESS OF WHETHER THE CAUSE OF ACTION IS FRAMED IN CONTRACT, NEGLIGENCE, ANY OTHER TORT, WARRANTY, STRICT LIABILITY, OR PRODUCT LIABILITY). In no event will Company's liability in connection with the provision of products or services or otherwise under this Agreement exceed the entire amount paid to Company by Customer under this Agreement.

20. CONTAMINANTS LIABILITY

The transmission of COVID-19 may occur in a variety of ways and circumstances, many of the aspects of which are currently not known. HVAC systems, products, services and other offerings have not been tested for their effectiveness in reducing the spread of COVID-19, including through the air in closed environments. **IN NO EVENT WILL COMPANY BE LIABLE UNDER THIS AGREEMENT OR OTHERWISE FOR ANY INDEMNIFICATION, ACTION OR CLAIM, WHETHER BASED ON WARRANTY, CONTRACT, TORT OR OTHERWISE, FOR ANY BODILY INJURY (INCLUDING DEATH), DAMAGE TO PROPERTY, OR ANY OTHER LIABILITIES, DAMAGES OR COSTS RELATED TO CONTAMINANTS (INCLUCING THE SPREAD, TRANSMISSION, MITIGATION, ELIMINATION, OR CONTAMINATION THEREOF) (COLLECTIVELY, "CONTAMINANT LIABILITIES") AND CUSTOMER HEREBY EXPRESSLY RELEASES COMPANY FROM ANY SUCH CONTAMINANTS LIABILITIES.**

21. Patent Indemnity. Company shall protect and indemnify Customer from and against all claims, damages, judgments and loss arising from infringement or alleged infringement of any United States patent by any of the goods manufactured by Company and delivered hereunder, provided that in the event of suit or threat of suit for patent infringement, Company shall promptly be notified and given full opportunity to negotiate a settlement. Company does not warrant against infringement by reason of Customer's design of the articles or the use thereof in combination with other materials or in the operation of any process. In the event of litigation, Customer agrees to reasonably cooperate with Company. In connection with any proceeding under the provisions of this Section, all parties concerned shall be entitled to be represented by counsel at their own expense.

22. Limited Warranty. Company warrants for a period of 12 months from the date of substantial completion ("Warranty Period") commercial equipment manufactured and installed by Company against failure due to defects in material and manufacture and that the labor/labour furnished is warranted to have been properly performed (the "Limited Warranty"). Trane equipment sold on an uninstalled basis is warranted in accordance with Company's standard warranty for supplied equipment. **Product manufactured by Company that includes required startup and is sold in North America will not be warranted by Company unless Company performs the product start-up**. Substantial completion shall be the earlier of the date that the Work is sufficiently complete so that the Work can be utilized for its intended use or the date that Customer receives beneficial use of the Work. If such defect is discovered within the Warranty Period, Company will correct the defect or furnish replacement equipment (or, at its option, parts therefor) and, if said equipment was installed pursuant hereto, labor/labour associated with the replacement of parts or equipment not conforming to this Limited Warranty. Defects must be reported to Company within the Warranty Period. Exclusions from this Limited Warranty include damage or failure arising from: wear and tear; corrosion, erosion, deterioration; Customer's failure to follow the Company-provided maintenance plan; refrigerant not supplied by Company; and modifications made by others to Company's equipment. Company shall not be obligated to pay for the cost of lost refrigerant. Notwithstanding the foregoing, all warranties provided herein terminate upon termination or cancellation of this Agreement. No warranty liability whatsoever shall attach to Company until the Work has been paid for in full and then said liability shall be limited to the lesser of Company's cost to correct the defective Work and/or the purchase price of the equipment shown to be defective. Equipment, material and/or parts that are not manufactured by Company ("Third-Party Product(s)" are not warranted by Company and have such warranties as may be extended by the respective manufacturer. **CUSTOMER UNDERSTANDS THAT COMPANY IS NOT THE MANUFACTURER OF ANY THIRD-PARTY PRODUCT(S) AND ANY WARRANTIES, CLAIMS, STATEMENTS, REPRESENTATIONS, OR SPECIFICATIONS ARE THOSE OF THE THIRD-PARTY MANUFACTURER, NOT COMPANY AND CUSTOMER IS NOT RELYING ON ANY WARRANTIES, CLAIMS, STATEMENTS, REPRESENTATIONS, OR SPECIFICATIONS REGARDING THE THIRD-PARTY PRODUCT THAT MAY BE PROVIDED BY COMPANY OR ITS AFFILIATES, WHETHER ORAL OR WRITTEN. THE WARRANTY AND LIABILITY SET FORTH IN THIS AGREEMENT ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESS OR IMPLIED, IN LAW OR IN FACT, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND/OR OTHERS ARISING FROM COURSE OF DEALING OR TRADE. COMPANY MAKES NO REPRESENTATION OR WARRANTY .OF ANY KIND, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. ADDITIONALLY, COMPANY MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND REGARDING PREVENTING, ELIMINATING, REDUCING OR INHIBITING ANY MOLD, FUNGUS, BACTERIA, VIRUS, MICROBIAL GROWTH, OR ANY OTHER CONTAMINANTS (INCLUDING COVID-19 OR ANY SIMILAR VIRUS) (COLLECTIVELY, "CONTAMINANTS"), WHETHER INVOLVING OR IN CONNECTION WITH EQUIPMENT, ANY COMPONENT THEREOF, SERVICES OR OTHERWISE. IN NO EVENT SHALL COMPANY HAVE ANY LIABILITY FOR THE PREVENTION, ELIMINATION, REDUCTION OR INHIBITION OF THE GROWTH OR SPREAD OF SUCH CONTAMINANTS INVOLVING OR IN CONNECTION WITH ANY EQUIPMENT, THIRD-PARTY PRODUCT, OR ANY COMPONENT THEREOF, SERVICES OR OTHERWISE AND CUSTOMER HEREBY SPECIFICALLY ACKNOWLDGES AND AGREES THERETO.**

23. Insurance. Company agrees to maintain the following insurance while the Work is being performed with limits not less than shown below and will, upon request from Customer, provide a Certificate of evidencing the following coverage:

Commercial General Liability	$2,000,000 per occurrence
Automobile Liability	$2,000,000 CSL
Workers Compensation	Statutory Limits

If Customer has requested to be named as an additional insured under Company's insurance policy, Company will do so but only subject to Company's manuscript additional insured endorsement under its primary Commercial General Liability policies. In no event does Company waive its right of subrogation.

24. Commencement of Statutory Limitation Period. Except as to warranty claims, as may be applicable, any applicable statutes of limitation for acts or failures to act shall commence to run, and any alleged cause of action stemming therefrom shall be deemed to have accrued, in any and all events not later than the last date that Company or its subcontractors physically performed work on the project site.

25. General. Except as provided below, to the maximum extent provided by law, this Agreement is made and shall be interpreted and enforced in accordance with the laws of the state or province in which the Work is performed, without regard to choice of law principles which might otherwise call for the application of a different state's or province's law. Any dispute arising under or relating to this Agreement that is not disposed of by agreement shall be decided by litigation in a court of competent jurisdiction located in the state or province in which the Work is performed. To the extent the Work site is owned and/or operated by any agency of the Federal Government, determination of any substantive issue of law shall be according to the Federal common law of Government contracts as enunciated and applied by Federal judicial bodies and boards of contract appeals of the Federal Government. This Agreement contains all of the agreements, representations and understandings of the parties and supersedes all previous understandings, commitments or agreements, oral or written, related to the subject matter hereof. This Agreement may not be amended, modified or terminated except by a writing signed by the parties hereto. No documents shall be incorporated herein by reference except to the extent Company is a signatory thereon. If any term or condition of this Agreement is invalid, illegal or incapable of being enforced by any rule of law, all other terms and conditions of this Agreement will nevertheless remain in full force and effect as long as the economic or legal substance of the transaction contemplated hereby is not affected in a manner adverse to any party hereto. Customer may not assign, transfer, or convey this Agreement, or any part hereof, or its right, title or interest herein, without the written consent of the Company. Subject to the foregoing, this Agreement shall be binding upon and inure to the benefit of Customer's permitted successors and assigns. This Agreement may be executed in several counterparts, each of which when executed shall be deemed to be an original, but all together shall constitute but one and the same Agreement. A fully executed facsimile copy hereof or the several counterparts shall suffice as an original.

26. Equal Employment Opportunity/Affirmative Action Clause. Company is a federal contractor that complies fully with Executive Order 11246, as amended, and the applicable regulations contained in 41 C.F.R. Parts 60-1 through 60-60, 29 U.S.C. Section 793 and the applicable regulations contained in 41 C.F.R. Part 60-741; and 38 U.S.C. Section 4212 and the applicable regulations contained in 41 C.F.R. Part 60-250 Executive Order 13496 and Section 29 CFR 471, appendix A to subpart A, regarding the notice of employee rights in the United States and with Canadian Charter of Rights and Freedoms Schedule B to the Canada Act 1982 (U.K.) 1982, c. 11 and applicable Provincial Human Rights Codes and employment law in Canada.

27. U.S. Government Work.

The following provision applies only to direct sales by Company to the US Government. The Parties acknowledge that all items or services ordered and delivered under this Agreement are Commercial Items as defined under Part 12 of the Federal Acquisition Regulation (FAR). In particular, Company agrees to be bound only by those Federal contracting clauses that apply to "commercial" suppliers and that are contained in FAR 52.212-5(e)(1). Company complies with 52.219-8 or 52.219-9 in its service and installation contracting business.

The following provision applies only to indirect sales by Company to the US Government. As a Commercial Item Subcontractor, Company accepts only the following mandatory flow down provisions in effect as of the date of this subcontract: 52.203-19; 52.204-21; 52.204-23; 52.219-8; 52.222-21; 52.222-26; 52.222-35; 52.222-36; 52.222-50; 52.225-26; 52.247-64. If the Work is in connection with a U.S. Government contract, Customer certifies that it has provided and will provide current, accurate, and complete information, representations and certifications to all government officials, including but not limited to the contracting officer and officials of the Small Business Administration, on all matters related to the prime contract, including but not limited to all aspects of its ownership, eligibility, and performance. Anything herein notwithstanding, Company will have no obligations to Customer unless and until Customer provides Company with a true, correct and complete executed copy of the prime contract. Upon request, Customer will provide copies to Company of all requested written communications with any government official related to the prime contract prior to or concurrent with the execution thereof, including but not limited to any communications related to Customer's ownership, eligibility or performance of the prime contract. Customer will obtain written authorization and approval from Company prior to providing any government official any information about Company's performance of the work that is the subject of the Proposal or this Agreement, other than the Proposal or this Agreement.

28. Limited Waiver of Sovereign Immunity. If Customer is an Indian tribe (in the U.S.) or a First Nation or Band Council (in Canada), Customer, whether acting in its capacity as a government, governmental entity, a duly organized corporate entity or otherwise, for itself and for its agents, successors, and assigns: (1) hereby provides this limited waiver of its sovereign immunity as to any damages, claims, lawsuit, or cause of action (herein "Action") brought against Customer by Company and arising or alleged to arise out of the furnishing by Company of any product or service under this Agreement, whether such Action is based in contract, tort, strict liability, civil liability or any other legal theory; (2) agrees that jurisdiction and venue for any such Action shall be proper and valid (a) if Customer is in the U.S., in any state or United States court located in the state in which Company is performing this Agreement or (b) if Customer is in Canada, in the superior court of the province or territory in which the work was performed; (3) expressly consents to such Action, and waives any objection to jurisdiction or venue; (4) waives any requirement of exhaustion of tribal court or administrative remedies for any Action arising out of or related to this Agreement; and (5) expressly acknowledges and agrees that Company is not subject to the jurisdiction of Customer's tribal court or any similar tribal forum, that Customer will not bring any action against Company in tribal court, and that Customer will not avail itself of any ruling or direction of the tribal court permitting or directing it to suspend its payment or other obligations under this Agreement. The individual signing on behalf of Customer warrants and represents that such individual is duly authorized to provide this waiver and enter into this Agreement and that this Agreement constitutes the valid and legally binding obligation of Customer, enforceable in accordance with its terms.

29. Building Automation Systems and Network Security. Customer and Trane acknowledge that Building Automation System (BAS) and connected networks security requires Customer and Trane to maintain certain cybersecurity obligations. Customer acknowledges that upon completion of installation and configuration of the BAS, the Customer maintains ownership of the BAS and the connected network equipment. Except for any applicable warranty obligations, Customer is solely responsible for the maintenance and security of the BAS and related networks and systems. In the event there is a service agreement between Trane and Customer, Trane will provide the services as set forth in the service agreement.

In order to maintain a minimum level of security for the BAS, associated networks, network equipment and systems, Customer's cybersecurity responsibilities include without limitation:

1. Ensure that the BAS, networks, and network equipment are physically secure and not accessible to unauthorized personnel.
2. Ensure the BAS remains behind a secure firewall and properly segmented from all other customer networks and systems, especially those with sensitive information.
3. Keep all Inbound ports closed to any IP Addresses in the BAS.
4. Remove all forwarded inbound ports and IP Addresses to the BAS.
5. Maintain user login credentials and unique passwords, including the use of strong passwords and the removal of access for users who no longer require access.
6. Where remote access is desired, utilize a secure method such as Trane Connect Secure Remote Access or your own VPN.
7. For any Trane services requiring remote data transfer and/or remote user access, configure the BAS and related firewall(s) per instructions provided by Trane. This typically includes configuring Port 443 and associated firewall(s) for Outbound only.
8. Perform regular system maintenance to ensure that your BAS is properly secured, including regular software updates to your BAS and related network equipment (i.e., firewalls).

Any and all claims, actions, losses, expenses, costs, damages, or liabilities of any nature due to Customer's failure to maintain BAS security responsibilities and/or industry standards for cybersecurity are the sole responsibility of the Customer.

1-26.251-10(1024)
Supersedes 1-26.251-10(0123)

SECURITY ADDENDUM

This Addendum shall be applicable to the sale, installation and use of Trane equipment and the sale and provision of Trane services. "Trane" shall mean Trane U.S. Inc. for sales and services in the United States, or Trane Canada ULC for sales and services in Canada.

1. **Definitions.** All terms used in this Addendum shall have the meaning specified in the Agreement unless otherwise defined herein. For the purposes of this Addendum, the following terms are defined as follows:

   "Customer Data" means Customer account information as related to the Services only and does not include HVAC Machine Data or personal data. Trane does not require, nor shall Customer provide personal data to Trane under the Agreement. Such data is not required for Trane to provide its Equipment and/or Services to the Customer.

   "Equipment" shall have the meaning set forth in the Agreement.

   "HVAC Machine Data" means data generated and collected from the product or furnished service without manual entry. HVAC Machine Data is data relating to the physical measurements and operating conditions of a HVAC system, such as but not limited to, temperatures, humidity, pressure, HVAC equipment status. HVAC Machine Data does not include Personal Data and, for the purposes of this agreement, the names of users of Trane's controls products or hosted applications shall not be Personal Data, if any such user chooses to use his/her name(s) in the created accounts within the controls product (e.g., firstname.lastname@address.com). HVAC Machine Data may be used by Trane: (a) to provide better support services and/or products to users of its products and services; (b) to assess compliance with Trane terms and conditions; (c) for statistical or other analysis of the collective characteristics and behaviors of product and services users; (d) to backup user and other data or information and/or provide remote support and/or restoration; (e) to provide or undertake: engineering analysis; failure analysis; warranty analysis; energy analysis; predictive analysis; service analysis; product usage analysis; and/or other desirable analysis, including, but not limited to, histories or trends of any of the foregoing; and (f) to otherwise understand and respond to the needs of users of the product or furnished service. "Personal Data" means data and/or information that is owned or controlled by Customer, and that names or identifies, or is about a natural person, such as: (i) data that is explicitly defined as a regulated category of data under any data privacy laws applicable to Customer; (ii) non-public personal information ("NPI") or personal information ("PI"), such as national identification number, passport number, social security number, social insurance number, or driver's license number; (iii) health or medical information, such as insurance information, medical prognosis, diagnosis information, or genetic information; (iv) financial information, such as a policy number, credit card number, and/or bank account number; (v) personally identifying technical information (whether transmitted or stored in cookies, devices, or otherwise), such as IP address, MAC address, device identifier, International Mobile Equipment Identifier ("IMEI"), or advertising identifier; (vi) biometric information; and/or (vii) sensitive personal data, such as, race, religion, marital status, disability, gender, sexual orientation, geolocation, or mother's maiden name.

   "Security Incident" shall refer to (i) a compromise of any network, system, application or data in which Customer Data has been accessed or acquired by an unauthorized third party; (ii) any situation where Trane reasonably suspects that such compromise may have occurred; or (iii) any actual or reasonably suspected unauthorized or illegal Processing, loss, use, disclosure or acquisition of or access to any Customer Data.

   "Services" shall have the meaning set forth in the Agreement.

2. HVAC Machine Data; Access to Customer Extranet and Third Party Systems. If Customer grants Trane access to HVAC Machine Data via web portals or other non-public websites or extranet services on Customer's or a third party's website or system (each, an "Extranet"), Trane will comply with the following:
   a. Accounts. Trane will ensure that Trane's personnel use only the Extranet account(s) designated by Customer and will require Trane personnel to keep their access credentials confidential.
   b. Systems. Trane will access the Extranet only through computing or processing systems or applications running operating systems managed by Trane that include: (i) system network firewalls; (ii) centralized patch management; (iii) operating system appropriate anti-malware software; and (iv) for portable devices, full disk encryption.
   c. Restrictions. Unless otherwise approved by Customer in writing, Trane will not download, mirror or permanently store any HVAC Machine Data from any Extranet on any medium, including any machines, devices or servers.
   d. Account Termination. Trane will terminate the account of each of Trane's personnel in accordance with Trane's standard practices after any specific Trane personnel who has been authorized to access any Extranet (1) no longer needs access to HVAC Machine Data or (2) no longer qualifies as Trane personnel (e.g., the individual leaves Trane's employment).
   e. Third Party Systems. Trane will provide Customer prior notice before it uses any third party system that stores or may otherwise have access to HVAC Machine Data, unless (1) the data is encrypted and (2) the third party system will not have access to the decryption key or unencrypted "plain text" versions of the HVAC Machine Data.

3. Customer Data; Confidentiality. Trane shall keep confidential, and shall not access or use any Customer Data and information that is marked confidential or by its nature is considered confidential ("Customer Confidential Information") other than for the purpose of providing the Equipment and Services, and will disclose Customer Confidential Information only: (i) to Trane's

employees and agents who have a need to know to perform the Services, (ii) as expressly permitted or instructed by Customer, or (iii) to the minimum extent required to comply with applicable law, provided that Trane (1) provides Customer with prompt written notice prior to any such disclosure, and (2) reasonably cooperate with Customer to limit or prevent such disclosure.

4. Customer Data; Compliance with Laws. Trane agrees to comply with laws, regulations governmental requirements and industry standards and practices relating to Trane's processing of Customer Confidential Information (collectively, "***Laws***").

5. Customer Data; Information Security Management. Trane agrees to establish and maintain an information security and privacy program, consistent with applicable HVAC equipment industry practices that complies with this Addendum and applicable Laws ("***Information Security Program***"). The Information Security Program shall include appropriate physical, technical and administrative safeguards, including any safeguards and controls agreed by the Parties in writing, sufficient to protect Customer systems, and Customer's Confidential Information from unauthorized access, destruction, use, modification or disclosure. The Information Security Program shall include appropriate, ongoing training and awareness programs designed to ensure that Trane's employees and agents, and others acting on Trane's, behalf are aware of and comply with the Information Security Program's policies, procedures, and protocols.

6. Monitoring. Trane shall monitor and, at regular intervals consistent with HVAC equipment industry practices, test and evaluate the effectiveness of its Information Security Program. Trane shall evaluate and promptly adjust its Information Security Program in light of the results of the testing and monitoring, any material changes to its operations or business arrangements, or any other facts or circumstances that Trane knows or reasonably should know may have a material impact on the security of Customer Confidential Information, Customer systems and Customer property.

7. Audits. Customer acknowledges and agrees that the Trane SOC2 audit report will be used to satisfy any and all audit/inspection requests/requirements by or on behalf of Customer. Trane will make its SOC2 audit report available to Customer upon request and with a signed nondisclosure agreement.

8. Information Security Contact. Trane's information security contact is Local Sales Office.

9. Security Incident Management. Trane shall notify Customer after the confirmation of a Security Incident that affects Customer Confidential Information, Customer systems and Customer property. The written notice shall summarize the nature and scope of the Security Incident and the corrective action already taken or planned.

10. Threat and Vulnerability Management. Trane regularly performs vulnerability scans and addresses detected vulnerabilities on a risk basis. Periodically, Trane engages third-parties to perform network vulnerability assessments and penetration testing. Vulnerabilities will be reported in accordance with Trane's cybersecurity vulnerability reported process. Trane periodically provides security updates and software upgrades.

11. Security Training and Awareness. New employees are required to complete security training as part of the new hire process and receive annual and targeted training (as needed and appropriate to their role) thereafter to help maintain compliance with Security Policies, as well as other corporate policies, such as the Trane Code of Conduct. This includes requiring Trane employees to annually re-acknowledge the Code of Conduct and other Trane policies as appropriate. Trane conducts periodic security awareness campaigns to educate personnel about their responsibilities and provide guidance to create and maintain a secure workplace.

12. Secure Disposal Policies. Trane will maintain policies, processes, and procedures regarding the disposal of tangible and intangible property containing Customer Confidential Information so that wherever possible, Customer Confidential Information cannot be practicably read or reconstructed.

13. Logical Access Controls. Trane employs internal monitoring and logging technology to help detect and prevent unauthorized access attempts to Trane's corporate networks and production systems. Trane's monitoring includes a review of changes affecting systems' handling authentication, authorization, and auditing, and privileged access to Trane production systems. Trane uses the principle of "least privilege" (meaning access denied unless specifically granted) for access to customer data.

14. Contingency Planning/Disaster Recovery. Trane will implement policies and procedures required to respond to an emergency or other occurrence (i.e. fire, vandalism, system failure, natural disaster) that could damage Customer Data or any system that contains Customer Data. Procedures include the following
    (i) Data backups; and
    (ii) Formal disaster recovery plan. Such disaster recovery plan is tested at least annually.

15. Return of Customer Data. If Trane is responsible for storing or receiving Customer Data, Trane shall, at Customer's sole discretion, deliver Customer Data to Customer in its preferred format within a commercially reasonable period of time following the expiration or earlier termination of the Agreement or, such earlier time as Customer requests, securely destroy or render unreadable or undecipherable each and every original and copy in every media of all Customer's Data in Trane's possession, custody or control no later than [90 days] after receipt of Customer's written instructions directing Trane to delete the Customer Data.

16. Background Checks Trane shall take reasonable steps to ensure the reliability of its employees or other personnel having access to the Customer Data, including the conducting of appropriate background and/or verification checks in accordance with Trane policies.

17. DISCLAIMER OF WARRANTIES. EXCEPT FOR ANY APPLICABLE WARRANTIES IN THE AGREEMENT, THE SERVICES ARE PROVIDED "AS IS", WITH ALL FAULTS, AND THE ENTIRE RISK AS TO SATISFACTORY QUALITY, PERFORMANCE, ACCURACY AND EFFORT AS TO SUCH SERVICES SHALL BE WITH CUSTOMER. TRANE DISCLAIMS ANY AND ALL OTHER EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES WITH RESPECT TO THE SERVICES AND THE SERVICES PROVIDED HEREUNDER, INCLUDING ANY EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR THAT THE SERVICES WILL OPERATE ERROR-FREE OR UNINTERRUPTED OR RETURN/RESPONSE TO INQUIRIES WITHIN ANY SPECIFIC PERIOD OF TIME.

October 2024
Supersedes: November 2023v2

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering.
3. Installation.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 011000 "Summary" for coordination of Owner-furnished products , Owner-performed work , Owner's separate contracts, and limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
5. Section 024116 "Structure Demolition" for demolition and removal of complete building.
6. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site .

1. Prior to submitting cutting and patching plan , review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
   a. Contractor's superintendent.
   b. Trade supervisor responsible for cutting operations.
   c. Trade supervisor(s) responsible for patching of each type of substrate.
   d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

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B. Layout Conference: Conduct conference at Project site .

1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect and Construction Manager of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
   a. Contractor's superintendent.
   b. Professional surveyor responsible for performing Project surveying and layout.
   c. Professional surveyor responsible for performing site survey serving as basis for Project design.
2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor .

B. Certified Surveys: Submit two copies signed by land surveyor .

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
   a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.6 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.

B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. 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.

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a. Primary operational systems and equipment.
b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Plumbing piping systems.
f. Mechanical systems piping and ducts.
g. Control systems.
h. Communication systems.
i. Fire-detection and -alarm systems.
j. Conveying systems.
k. Electrical wiring systems.
l. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or 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. Other construction elements include but are not limited to the following:
   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain-wall construction.
   d. Sprayed fire-resistive material.
   e. Equipment supports.
   f. Piping, ductwork, vessels, and equipment.
   g. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction 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.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. 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 EXAMINATION

A. Existing Conditions: 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, mechanical and electrical systems, and other construction affecting the Work.

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1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, 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. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. 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. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect through Construction Manager in accordance with requirements in Section 013100 "Project Management and Coordination."

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 and existing conditions. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following 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 limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.

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6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. 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 rim 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 and Construction Manager.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Engage a land surveyor to 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. 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.

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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 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

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 satisfactory results as judged by Architect. 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 of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."

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F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. 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 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.

H. 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 practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.
3. 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 in-place 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, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place 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 and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.
2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.

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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 personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. 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 waste materials more than seven days during normal weather or three 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, in accordance with regulations.
   a. Use containers intended for holding waste materials of type to be stored.
4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

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 in accordance with 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. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

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3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 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. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for coordination of responsibilities for waste management.
2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
3. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction 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 demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award.

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1.6 INFORMATIONAL SUBMITTALS

A. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

B. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

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3.2 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

3.3 ATTACHMENTS

END OF SECTION 017419

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. List of incomplete items.
4. Submittal of Project warranties.
5. Final cleaning.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

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1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
5. Submit testing, adjusting, and balancing records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. 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. 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.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

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1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect and Construction Manager.
   d. Name of Contractor.
   e. Page number.
4. Submit list of incomplete items in the following format:
   a. MS Excel Electronic File: Architect , through Construction Manager, will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

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 Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Architect .

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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 FINAL CLEANING

A. General: Perform 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 designated portion of Project:
   a. Clean Project site 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 not planted, mulched, or 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. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
   i. Vacuum and mop concrete.
   j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
   k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
   l. Remove labels that are not permanent.
   m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
      1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
   p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
   q. Clean strainers.
   r. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."

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3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Systems and equipment operation manuals.
3. Systems and equipment maintenance manuals.
4. Product maintenance manuals.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
2. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
3. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 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.

1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit on digital media acceptable to Architect . Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

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D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: 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: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

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.

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.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists,

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assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

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.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has 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.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.

D. 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. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.8 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

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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.

B. 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 warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; 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.
   a. 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.
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.

E. 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.

F. 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 recording maintenance.

G. 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.

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.

I. 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 maintenance manuals.

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1.9 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. 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.

C. 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 and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.

E. 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.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. 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 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for coordinating Project Record Documents covering the Work of multiple contracts.
2. Section 017300 "Execution" for final property survey.
3. Section 017700 "Closeout Procedures" for general closeout procedures.
4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of Record Drawings as follows:
    a. Initial Submittal:
        1) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
        2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    b. Final Submittal:
        1) Submit PDF electronic files of scanned Record Prints and one set(s) of file prints.
        2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files and one paper copies of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.4 RECORD DRAWINGS

A. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

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1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect through Construction Manager for resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
    a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect and Construction Manager.
    e. Name of Contractor.

1.5 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. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
3. Note related Change Orders , Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file .

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. 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 Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file .

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

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1.7 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.

B. Format: Submit miscellaneous record submittals as PDF electronic file .

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

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SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor .

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "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.

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1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.
2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Systems and equipment operation manuals.
   c. Systems and equipment maintenance manuals.
   d. Product maintenance manuals.
   e. Project Record Documents.
   f. Identification systems.
   g. Warranties and bonds.
   h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

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5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. 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 Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

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PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

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SECTION 024119 - SELECTIVE DEMOLITION

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. Demolition and removal of selected portions of building or structure.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.

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. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition 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 demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

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1.5 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition 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 demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and , for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and 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 and of Owner's partial occupancy of completed Work.

C. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Present in buildings and structures to be selectively demolished. 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.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

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1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

1. Roofing System .

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.9 COORDINATION

A. Arrange selective demolition 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 ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

3.2 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 demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

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3.3 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 demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition 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 24 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 demolition 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 017419 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during

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selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. 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.

B. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 075113 Buit up asphalt roofing for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
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 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

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SECTION 032100 - STEEL CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.02 **RELATED WORK SPECIFIED ELSEWHERE**

A. Cast-In-Place Concrete: Section 033000.

1.03 **REFERENCES**

A. Codes and standards referred to in this Section are:
1. ACI SP66 – ACI Detailing Manual
2. ACI 318 – Latest Edition "Building Code Requirements for Reinforced Concrete"
3. ASTM A615/A615M – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
4. AWS D1.4 – Structural Welding Code – Reinforcing Steel

1.04 **SUBMITTALS**

A. Shop Drawings: Placing drawings for all reinforcing steel and bending diagrams. Machine-duplicated copies of Contract Drawings will not be accepted as shop drawings. Shop drawings shall be standard 24 by 36 inch size sheets, except that erection drawings may be larger. The margin line shall be drawn a minimum of 1/2 inch from edge of sheet. The title block shall be placed in the lower right hand corner of the drawing, and shall contain the fabricator's name, address, and telephone number. Failure to submit legible drawings of required size will be cause for their disapproval without review.
1. When shop drawings are marked "Approved as Noted", promptly resubmit copies of corrected shop drawings for formal approval and record.
2. Contract Drawings are not considered released for construction. Orders for materials may be placed only after approval of erection drawings or written approval of the Director.

B. Certificates: Affidavit by the bar reinforcement manufacturer certifying that bar material meets the contract requirements.
1. Submit evidence of steel material compliance with this Specification. Evidence shall consist of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement

1.05 Delivery, Storage, and Protection

A. Reinforcing steel shall be stored off the ground and protected from oil or other materials detrimental to the steel or bonding capability of the reinforcing bar.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bar Reinforcement: ASTM A 615, Grade 60, deformed steel bars.

B. Welded Wire Reinforcement: ASTM A 185, welded wire fabric, fabricated into flat sheets unless otherwise indicated.
   1. Epoxy-Coated Fabric Reinforcement: ASTM A 884, Class A.
      a. Epoxy Coating Patching Material: ASTM A 775.

C. Bar Supports; Either of the Following Types:
   1. Galvanized steel or AISI Type 430 stainless steel, and without plastic tips.
   2. Insoluble plastic, with minimum 1,500 psi tensile strength and capable of retaining fabricated shape at temperatures between 5 degrees F and 170 degrees F.

D. Welded Wire Reinforcement Supports:
   1. Shall comply with CRSI RB4.1
   2. Tie Wire: Black annealed wire, 16-1/2 gage or heavier.

E. Steel Wire: ASTM A 82, cold-drawn plain steel wire, size No. W2.9 unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Placement: Place all bars in accordance with CRSI “Recommended Practice for Placing Reinforcing Bars”.

B. Tolerances: Place bars used for top reinforcement in slabs to a vertical tolerance plus or minus 1/4-inch. Place all other reinforcement to the tolerances given to ACI 318.

C. Cleaning: Have reinforcing steel delivered without rust other than that accumulated during transportation to the work. At all times, fully protect reinforcing steel from moisture, grease, dirt, mortar and concrete. Before being placed in position, thoroughly clean reinforcing steel of all loose mill scale and rust and of any dirt, oil, grease coatings, or other material that might reduce the bond. If there is a delay in depositing concrete, inspect and satisfactorily clean the steel immediately before the concrete is placed.

D. Bar positioning: Place bars in the exact positions shown with the required spacing and cross wire bars securely in position at intersections to prevent displacement during the placing of the concrete. Fasten the bars with annealed wire of not less than 17 gauge or other approved devices.

E. Bar Extension Beyond Formwork: ON any section of the work where horizontal bars extend beyond the length of the forms, perforate the form of head against which the work ends or at the proper places to allow the bars to project through a distance at least equal to the lap specified.

F. Unacceptable Materials: Do not place reinforcing steel with damaged, unsuitably bonded epoxy-coating or rusting. If approved, mars, exposed threads of mechanical connections, and cut ends may be field coated with approved epoxy coating material.

G. Review of Placement. Have reinforcing placement reviewed by the third-party inspector before concrete is placed.

H. Welding: Do not use reinforcing bar assemblies made by welding of any kind, or accessories of any kind which require field welding to reinforcing bars.

I. Tension and Compression Lap Splices: Conform tension and compression lap splices to ACI 318 with all supplements. Avoid splices at points of maximum tensile stress wherever possible. Provide temperature bars with clear spacing shown. Stagger all bar splices in hoop tension bars in circular tanks with not more than 50 percent of bars spliced in any one direction. Have welded splices made by certified welders in accordance with AWS D1.4.

J. Welded Wire Fabric: Place welded wire fabric in the positions shown, specified or required to fit the work. Furnish and place suitable spacing chairs or supports, as specified for bars, to maintain the fabric in the correct location. Where a flat surface of fabric is required, provide flat sheets, when available. Otherwise, reverse roll the fabric or otherwise straighten to make a perfectly flat surface before placing. Obtain approval for the length of laps not indicated.

K. Concrete Cover: Place reinforcing steel and welded wire fabric and hold in position so that the concrete cover, as measure from the surface of the bar or wire to the surface of the concrete, is as shown or specified.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Steel Concrete Reinforcement: Section 032100.

1.03 REFERENCES

A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of American Concrete Institute (ACI) and American Society for Testing and Materials (ASTM) documents.
   1. ACI 117-10: Specifications for Tolerances in Concrete Construction and Materials
   2. ACI 212.3R-10:Report on Chemical Admixtures for Concrete; Chapter 15 Permeability Reducing Admixtures
   3. ACI 301-16: Specification for Structural Concrete for Buildings.
   4. ACI 304.2R-96: Placing Concrete by Pumping Methods.
   5. ACI 305R-10: Guide for Hot Weather Concreting.
   6. ACI 306R-10: Guide to Cold Weather Concreting.
   7. ACI 308.1-11: Standard Specification for Curing Concrete.
   8. ACI 318 -14 Building Code Requirements for Structural Concrete.
   9. ACI 360R-10: Guide to Design of Slabs on Grade
   10. ASTM C 94/C 94M – 11b: Standard Specification for Ready- Mixed Concrete.
   11. ASTM C 494/C 494M - 11: Standard Specification for Chemical Admixtures for Concrete.

1.04 SUBMITTALS

A. Submittals Package: Submit product data for design mix(es) and materials for concrete specified below at the same time as a package.

B. Product Data:
   1. Mix Design: Submit proposed concrete design mix(es) together with name and location of batching plant at least 28 days prior to the start of concrete work.
      a. Include test results of proposed concrete proportions based on previous field experience or laboratory trial batches in accordance with ACI 301, Section 4.
      b. Pumped Concrete: Include test results of proposed design mix(es) tested under actual field conditions with the maximum horizontal run and vertical lift required for this project.
   2. Portland Cement: Brand and manufacturer’s name.

3. Fly Ash: Name and location of source, and DOT test numbers.
4. Air-entraining Admixture: Brand and manufacturer's name.
5. Water-reducing Admixture: Brand and manufacturer's name.
6. High Range Water-reducing Admixture (Superplasticizer): Brand and manufacturer's name.
7. Accelerating Admixture: Brand and manufacturer's name.
8. Aggregates: Name and location of source, and DOT test numbers.
9. Expansion Joint Fillers: Brand and manufacturer's name.

C. Quality Control Submittals:
1. Batching Plant Records: At the end of each day of placing concrete, furnish the Director's Representative with a legible copy of all batch records for the concrete placed.
2. Concrete Pumping Equipment Data: Include manufacturer's name and model of principal components, type of pump, and type and diameter of pipe/hose.
3. Minutes of the previous pre-installation conference.

1.05 QUALITY ASSURANCE

A. Qualifications of Crew Pumping Concrete: Workers pumping concrete shall have had at least one year of experience pumping concrete.

B. Pre-Construction Conference: A minimum of 14 days prior to the initial submission of shop drawings, a conference will be held by the Contractor at the Site for the purpose of reviewing the Contract Documents, and discussing the requirements and procedures for submittals and for the Work. The conference shall be attended by the Contractor, the concrete supplier representative, the reinforcement fabricator's project coordinator, and a representative of the Structural Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C 150, Type I or II Portland cement.

B. Water: ASTM C94 and Potable

C. Air-entraining Admixture: ASTM C 260

D. Mid-Range Water-reducing Admixture: ASTM C 494/C 494M, Type A

E. High Range Water-reducing Admixture (Superplasticizer): ASTM C 494/C 494M, Type F

F. Retarding Admixture: ASTM C 494, Type D, Water-reducing and retarding, for use in hot weather concreting.

G. Accelerating Admixture: Non-corrosive admixture, containing no chloride, complying with ASTM C 494, Type C or E

H. High Range Water-reducing and Retarding Admixture: ASTM C 494, Type G

I. Fly Ash: ASTM C 618, Class F

J. Fine Aggregates: ASTM C33

K. Normal Weight Aggregates: ASTM C33, 3/4" maximum

L. Lightweight Aggregates: ASTM C 330

M. Moisture-Retaining Cover: Waterproof paper, polyethylene film, or polyethylene-coated burlap complying with ASTM C 171.

N. Premolded Expansion Joint Filler: Preformed material complying with ASTM D 1752 or ASTM D994, 3/8" thick unless otherwise indicated.

O. Epoxy Joist Filler: Two-Component semi-rigid resin, 100% solids, and having a minimum Shore A Hardness of 80 when measured in accordance with ASTM D 2240.

2.02 PROPORTIONING OF MIXES

A. Cast-in-place concrete shall be air-entrained normal weight concrete except where lightweight concrete is indicated on the drawings.
   1. Normal weight concrete shall have a minimum compressive strength as specified on the drawings.
      a. Slump: Maximum 4 inches; minimum 2 inches before the addition of any water-reducing admixtures or high-range water-reducing admixtures (superplasticizers) a maximum of 6 inches after the addition of mid-range water-reducing admixture, and a maximum of 8 inches after addition of high range water reducing admixture.
   2. Optional Material: Fly ash may be substituted for (Portland) cement in normal weight and lightweight concrete at 15 percent to 25 percent by weight of the required minimum (Portland) cement. If fly ash is incorporated in a concrete design mix, make necessary adjustments to the design mix to compensate for the use of fly ash as a partial replacement for (Portland) cement.
      a. Adjustments shall include the required increase in air-entraining admixture to provide the specified air content.
      b. Lower early strength of the concrete shall be considered in deciding when to remove formwork.

B. Slump for Pumped Concrete: When a water-reducing admixture is not used, maximum slump shall be 4 inches. When a water-reducing admixture is used, maximum slump shall be 6 inches and when a high-range water-reducing admixture (superplasticizers) is used, maximum slump shall be 8 inches.

C. Design Air Content: Design air content shall be 5 percent for air-entrained concrete with an allowable tolerance of plus or minus 1.5 percent for total air content, 3" maximum for non-air entrained concrete, and 4 percent minimum for light weight concrete. Use air-entraining admixture, not air-entrained cement.

D. Water-Cement Ratio: Cast-in-place concrete shall have a maximum water-cement ratio as indicated on the drawings.

E. Admixtures: Do not use admixtures in concrete unless specified or approved in writing by the Engineer.

2.03 **PRODUCTION OF CONCRETE**

A. Provide ready-mixed concrete, either central-mixed or truck-mixed, unless otherwise approved in writing by the Engineer.

B. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.
   1. In cold weather, comply with ACI 306R.
      a. When air temperature is below 40 degrees F (4 degrees C) heat the mixing water and, if necessary, the aggregates to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees C) at point of placement. If the mixing water is heated, do not exceed a temperature of 140 degrees F at the time it is added to the cement and aggregates.
   2. In hot weather, comply with ACI 305R.
      a. When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 **EXAMINATION AND PREPARATION**

A. Do not use items of aluminum for mixing, chuting, conveying, forming or finishing concrete, except magnesium alloy tools may be used for finishing.

B. Check items of aluminum required to be embedded in the concrete and insure that they are coated, painted or otherwise isolated in an approved manner.

C. Install waterstops in accordance with manufacturer's printed instructions.

D. Hardened concrete, reinforcement, forms, and earth which will be in contact with fresh concrete shall be free from frost at the time of concrete placement.

E. Do not deposit concrete in water. Keep excavations free of water by pumping or by other approved methods.

F. Prior to placement of concrete, remove all hardened concrete spillage and foreign materials from the space to be occupied by the concrete.

3.02 ADMIXTURE ADDITIONS AT THE SITE

A. Site additions shall be limited to high-range water-reducers, non-chloride accelerators, and corrosion inhibitors. Comply with manufacturers' printed instructions for discharge of admixtures shall be furnished.

B. High-Range Water-Reducers:

1. Concrete shall arrive at a slump of 2 to 4 inches (50 to 100 mm). Water additions at the Site shall be limited to comply with water-to-cementitious ratio requirements.
2. Following addition of high-range water-reduced concrete, a minimum of 70 revolutions or 5 minutes of mixing shall be completed to assure a consistent mixture.

C. All concrete with other admixture additions shall mix a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.

3.03 FINISHING FORMED SURFACES

A. Finish Schedule: Except where indicated otherwise on the Drawings, provide the finishes below:
1. Rough Form Finish for concrete surfaces not exposed to view.
2. Smooth Form Finish for concrete surfaces exposed to view.
3. Smooth Rubbed Finish for exterior concrete surfaces exposed to view.
4. Grout Cleaned Finish for interior concrete surfaces exposed to view.

3.04 SLABS

A. Slabs On Grade: Provide key type joints unless otherwise shown. Tool exposed joints.

B. Finish Schedule: Except where indicated otherwise on the Drawings, provide the finishes below:
1. Floated Finish for:
   a. Treads and platforms of exterior steps and stairs.
   b. Slabs and fill over which waterproofing, roofing, vapor barrier, insulation, terrazzo, or resin bound flooring is required.
2. Troweled Finish for:
   a. Interior slabs that are to be exposed to view.
   b. Slabs and fill over which resilient wood flooring, resilient tile or sheet flooring, carpet, or thin-film coating system is required.
   c. Slabs and fill over which thin-set ceramic tile is required, except fine-broom finished surface.
   d. Treads and platforms of interior steps and stairs.
3. Broom Finish for:

a. Exterior slabs.

3.05 REPAIR OF DEFECTS

A. After forms have been removed, any concrete which is not constructed as shown on the plans or is out of alignment or level beyond required tolerances or which shows a defective surface which, in the opinion of the Engineer, cannot be properly repaired or patched shall be removed.

B. Where cast-in-place concrete exposed to view (including under the pier) requires repairing or patching, the texture and color of the surface of such repair or patch shall closely match that of the surrounding surface.

C. All tie holes and all repairable defective areas shall be patched immediately after form removal as follows:
1. All honeycombed concrete shall be chipped out to sound concrete along neat lines, but in no case to a depth of less than 1 inch. If possible, edges of the chipped-out areas shall be slightly undercut.
2. Rock pockets, form tie holes, deep holes not too large in area, other holes with relatively high ratio of depth to area, and similarly confined areas shall be dry packed. After the area to be patched has been thoroughly cleaned and dampened, the mortar, which shall consist of 1 part cement, 2-1/2 parts sand passing a #16 screen, and only enough water to produce a mortar that will stick together upon being molded into a ball by slight pressure of the hands, shall be placed in the holes in layers having a compacted thickness of about 3/8". Each such layer shall be solidly rammed over its entire surface using a hardwood stick and a hammer.
3. Shallow depressions where lateral restraint cannot be obtained, voids behind reinforcement, and holes extending through concrete sections shall be patched using a commercially prepared bonding agent and a stiff mortar mix of 1 part cement and not more than 2-1/2 parts sand. For filling holes in exterior surfaces, an epoxy bonding agent shall be used. Application of the bonding agent shall be in strict conformance with the manufacturer's instructions.
4. An epoxy-and-sand mixture may be used in lieu of the mortar-and-bonding agent mixture for any of the patching above. The preparation of the surface to receive the patch, as well as the mixture proportions of the epoxy and sand, shall be in strict conformance with themanufacturer's instructions.

D. Except for concrete required to be removed under paragraph 3.6 A, any concrete which is not constructed as shown on the plans or is out of alignment and/or level beyond allowable tolerances may be patched using an epoxy-and-sand mixture. The proportions of the mix and the preparation of the surface to receive the patch shall be in strict conformance with the manufacturer's instructions except as otherwise specified herein. The minimum thickness of the patch shall be 1/4". No "feathering" to a lesser thickness will be permitted. Misalignment which requires correction more than 1 inch thickness shall be repaired in the following manner:
1. The surface of the affected area shall be chipped, etched, or otherwise cleaned and roughened to provide a sound surface for bonding;

2. Concrete nails or other fasteners which can provide positive mechanical bonding of the patch shall be set into the surface at about 18 inches o.c. in all directions with a minimum of 2 rows;
3. Reinforcement as approved by the Engineer shall be installed in those portions of the patch which exceed 2 inch thickness;
4. A bonding agent suitable for use in the repair location (epoxy required for exterior use) shall be applied over the entire surface to be patched;
5. Formwork to the true lines called for shall be installed over the area requiring the patch; and
6. Concrete or grout with aggregate sized appropriately for the cavity and which will provide strength equivalent to that of the base surface shall be placed in the form, properly compacted, finished, and suitably cured.

E. Shrinkage and temperature cracks in exposed concrete except slabs on grade shall be patched by veeing out the crack to a minimum width and depth of 1/4" and filling solid with epoxy mortar. Whenever necessary, the Engineer may require cracks be repaired and patched by epoxy injection and require the Contractor to submit methods of repair for approval before the commencement of the repair work.

3.06 CURING AND PROTECTION

A. Hot Weather Concreting: Comply with ACI 305R whenever the atmospheric temperature or the form surface temperature is at or above 90 degrees F., or climatic conditions of wind and/or low humidity will cause premature drying of the concrete.

B. Curing Temperature: Maintain the temperature of the concrete at 50 degrees F. or above during the curing period. Keep the concrete temperature as uniform as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceeds 5 degrees F. in any one hour and 50 degrees F. in any 24-hour period.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspection agency to perform tests and inspections and submit reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain on composite sample of 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. 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing

shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and field cure five standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two field cured specimens at 7 days and one set of two specimens at 28 days.
   a. 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.
   b. Additional specimen shall be held for test at 56 days in case of low test results.
9. 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.

C. Test results will be reported in writing to the Engineer, Ready-Mix Producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, Windsor probe, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The Engineer shall require additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Engineer. The testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Pay for such tests

when unacceptable concrete is verified, including all inspection and Engineering fees when non-conforming work is verified.

END OF SECTION

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Brick.
3. Mortar and grout materials.
4. Reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Mortar and grout mixes.

B. Products Installed but not Furnished under This Section:

1. Cavity wall insulation adhered to masonry backup.

C. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
2. Section 096313 "Brick Flooring" for interior brick flooring.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. brick , in the form of straps of five or more bricks.
3. Colored mortar.
4. Weep/cavity vents.

C. Samples for Verification: For each type and color of the following:

1. brick , in the form of straps of five or more bricks.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Weep/cavity vents.

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4. Cavity drainage material.
5. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

C. 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 in accordance with TMS 602.

D. 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. Qualifications:

1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.

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. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

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1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry by testing masonry prisms in accordance with ASTM C1314.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

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B. CMUs: ASTM C90, normal weight unless otherwise indicated.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi .
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.4 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

B. Building (Common) Brick: ASTM C62, Grade SW .

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2100 psi .
2. Size (Actual Dimensions): match existing .

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

D. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C , and recommended by manufacturer for use in masonry mortar of composition indicated.

E. Water: Potable.

2.6 REINFORCEMENT

A. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

B. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Exterior Walls: Hot-dip galvanized carbon steel.
2. Wire Size for Side Rods: 0.148-inch diameter.
3. Wire Size for Cross Rods: 0.148-inch diameter.
4. Wire Size for Veneer Ties: 0.148-inch diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 ft. , with prefabricated corner and tee units.

C. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.

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2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.

2.7 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
3. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
4. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
5. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304.

C. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.0336-inch- thick steel sheet, galvanized after fabrication .

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long for masonry constructed from solid units.
2. Where wythes do not align , use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.

E. 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. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

F. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication .

G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated .

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M Rust-inhibitive paint.

2.8 EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 , 0.016 inch thick.
2. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16 oz./sq. ft. weight or 0.0216 inch thick or ASTM B370, 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 ft.. Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate through-wall metal flashing embedded in masonry from stainless steel copper, with sawtooth ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
5. 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.

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6. Solder metal items at corners.

B. 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 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. For exterior masonry, use portland cement-lime mortar.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S .
3. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments do not exceed 10 percent of portland cement by weight.
2. Pigments do not exceed 5 percent of masonry cement by weight.
3. Mix to match Architect's sample.

E. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

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B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. 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 ft., 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 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., 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 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., 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 ft., 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.

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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.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches . Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs and hollow brick as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units and hollow brick 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.

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C. Lay structural clay tile as follows:

1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- thick joints.

D. Set firebox brick in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 inch. Tool joints smooth on surfaces exposed to fire or smoke.

E. Install clay flue liners to comply with ASTM C1283. Install flue liners ahead of surrounding masonry. Set clay flue liners in full bed of refractory mortar 1/16 to 1/8 inch thick. Strike joints flush on inside of flue to provide smooth surface. Maintain expansion space between flue liner and surrounding masonry except where surrounding masonry is required to provide lateral support for flue liners.

F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

G. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

H. Cut joints flush where indicated to receive waterproofing cavity wall insulation air barriers unless otherwise indicated.

3.6 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods :

1. Individual Metal Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
   a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
   a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes .
   b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Bond wythes of composite masonry together using bonding system indicated on Drawings.

C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

D. Collar Joints in Clay Tile Masonry: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with mortar at exterior walls, except cavity walls .

E. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

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F. Intersecting and Abutting Walls: Unless vertical expansion or control joints are indicated at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 8 inches o.c.

3.7 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods :

1. Individual Metal Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. 1.77 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
   a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
   b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.
2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
   a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes .
   b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
   c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than 8 inches clear horizontally and 16 inches clear vertically.
4. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Parge cavity face of backup wythe in a single coat approximately 3/8 inch thick. Trowel face of parge coat smooth.

E. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as indicated.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 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.

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E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 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. Install preformed control-joint gaskets designed to fit standard sash block.
2. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

3.10 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier , lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
3. At lintels and shelf angles, extend flashing 6 inches minimum , to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum , to edge of next full unit and turn ends up not less than 2 inches to form end dams.
4. Interlock end joints of sawtooth sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
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.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 24 inches o.c. unless otherwise indicated.
4. Space weep holes formed from plastic tubing 16 inches o.c.

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5. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
6. Trim wicking material flush with outside face of wall after mortar has set.

D. Place cavity drainage material in cavities airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

E. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products or open-head joints to form cavity vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.11 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 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 .

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. 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 will be at Contractor's expense.

B. Testing Prior to Construction: One set of tests.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.

E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

F. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

H. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at 7 days and at 28 days.

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3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

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SECTION 051200 - STRUCTURAL STEEL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.02 REFERENCES

A. Design, Fabrication, and Erection: “Specification for Structural Steel Buildings”, by the American Institute of Steel Construction (AISC Specification).
B. Fabrication and erection practices shall comply with the “Code of Standard Practice for Steel Buildings and Bridges”, by the American Institute of Steel Construction (AISC Code).
C. Welding shall comply with the provisions of the “Structural Welding Code - Steel, AWS D1.1”, by the American Welding Society (AWS Code).
D. High-Strength Bolting: High-strength bolting shall comply with the “Specification for Structural Joints Using High-Strength Bolts” (Specification for Structural Joints).
E. Cleaning Steel: Comply with the appropriate specifications (SSPC SP-X) by the Steel Structures Painting Council.
5. Cleaning Steel: Comply with the appropriate specifications (SSPC SP-X) by the Steel Structures Painting Council.

1.03 REQUIREMENTS FOR CONNECTIONS

A. General:

1. Do not use connection details which depend upon sharing the stress between any combination of high-strength bolts in bearing-type connections and welds.
2. Size connections for the loads indicated on the Drawings. If the loads are not indicated, use a connection whose capacity is half the total uniform load capacity shown in the “Allowable uniform loads in kips for beams laterally supported” tables in the AISC Manual for the given shape, span, and steel specification of the beam in question, unless otherwise indicated.
3. All bolted connections shall have a minimum of two bolts.

B. Shop Connections: Unless otherwise indicated, all shop connections shall be welded or high strength bolted.

C. Field Connections:

1. Field connections shall be welded or high-strength bolted tightened to the snug tight condition.

1.04 SUBMITTALS

A. Shop Drawings: Submit shop drawings for all structural steel required by this Contract. Machine-duplicated copies of Contract Drawings will not be accepted as shop drawings. Shop drawings shall be standard 24 by 36 inch size sheets, except that erection drawings may be larger. The margin line shall be drawn a minimum of 1/2 inch from edge of sheet. The title block shall be placed in the lower right hand corner of the drawing, and shall contain the fabricator's name, address, and telephone number. Failure to submit legible drawings of required size will be cause for their disapproval without review. If the drawings are not prepared by a detailer under the direct control of the fabricator, the fabricator shall stamp each drawing and initial or sign the stamp to certify review and approval of the drawings, and conformance with the fabricator's shop practice and capability.

1. Include the following in the initial submission:
   a. Drawings of proposed job standards for shop and field connections, including standard and special connections, complying with the requirements.
   b. Erection drawings indicating sizes, weights, and locations of all structural members.
2. All shop drawings shall be checked by the detailer before submission. Failure to submit checked shop drawings will be cause for their disapproval without review.
3. Changes initiated by the detailer or fabricator to previously reviewed shop drawings shall be resubmitted.
4. Include the following in subsequent submissions:
   a. Index sheets and revised erection drawings to which erection marks have been added.
   b. Detail drawings of all structural members.
5. Indicate all required shop and field welds by Standard AWS Welding Symbols in accordance with AWS A2.4.
6. Indicate shop painting requirements.
7. When shop drawings are marked "Approved as Noted", promptly resubmit copies of corrected shop drawings for formal approval and record.
8. Contract Drawings are not considered released for construction. Orders for materials may be placed only after approval of erection drawings or written approval of the Director.

B. Product Data:

1. Shop Paint: Manufacturer's name and printed product literature, including storage and application instructions.

C. Quality Control Submittals:

1. Test Reports: Submit test reports no later than the end of the week covered by the reports. Submit copy of each test report required under Quality Assurance Article.
2. Certificates: Certificates required under Quality Assurance Article.

3. Fabricator's Qualifications Data:
   a. Firm's name, business address and telephone number.
   b. Summary of their quality control programs.
4. Erector's Qualifications Data:
   a. Firm's name, business address and telephone number.
   b. Summary of their quality control programs.
5. Welder's Qualifications Data:
   a. Name of each person who will be performing the Work and their employer's name, business address and telephone number.
   b. Copy of AWS certification for type of welding required.

1.05 QUALITY ASSURANCE

A. Test Reports:

1. Steel Manufacturer's Mill Test Reports: Covering physical and chemical tests, for all main material.
2. Bolt Manufacturer's Test Reports: Covering physical and chemical tests, for each lot of high strength bolts supplied.

B. Certification: Affidavit by the structural steel manufacturer certifying that structural steel items meet the contract requirements.

1. Submit evidence of steel material compliance with this Specification. Evidence shall consist of certification of source of material, copies of purchase orders and manufacturer's certifications. For stock material, submit copies of latest mill or purchase orders for material replacement.

C. Qualifications:

1. Fabricator's Qualifications: The fabricator of the structural steel shall be regularly engaged in the fabrication of structural steel for a minimum of 5 years, and shall be subject to the approval of the Engineer.
   a. AISC Quality Certified Fabricators (latest list issued) are approved.
2. Erector's Qualifications: The structural steel erector shall be regularly engaged in the erection of structural steel for a minimum of 5 years, and shall be subject to the approval of the Engineer.
3. Welders' Qualifications: Welding shall be performed only by welders, welding operators, and tackers who have been qualified by tests as prescribed in the AWS Code to perform the type of welding required. Welders shall be certified for each type weld and position before fabrication.

D. Do not deviate from the requirements of the Contract Documents except where an option is specifically mentioned. The Engineer, however, may accept deviations proposed by the Contractor when it is deemed in the best interest of the project and if the deviations are consistent with sound and accepted engineering practice. Requests for deviations shall be made prior to the submission of shop drawings to preclude delay in the expeditious preparation and

approval of the required shop drawings. In addition, design calculations or other data may be required to establish conformity of such deviations with the applicable Standards.

E. Galvanizing: Stamp galvanized items with galvanizer's name, weight of coating, and applicable ASTM number.

F. Pre-Fabrication Meeting: A minimum of 14 days prior to the initial submission of shop drawings, a meeting will be held at the Site for the purpose of reviewing the Contract Documents, and discussing the requirements and procedures for submittals and for the Work. The meeting will be conducted by the Contractor and the fabricator's project coordinator and certified welding inspector must attend the meeting. A representative of the Structural Engineering will also attend.

1.06 QUALITY ASSURANCE

A. Examine Drawings and Specifications prior to bidding or executing work. Notify the Engineer immediately should omissions or errors be discovered.
B. All welders, both shop and field, shall be certified qualified operators, in accordance with the requirements of the American Welding Society.

1.07 WELDING PROCESSES

A. Use only shielded metal arc, submerged arc, gas metal arc, or flux cored arc welding.

1.08 WELDING PROCEDURE QUALIFICATION

A. Shielded metal arc, submerged arc, gas metal arc, or flux cored arc welding procedures which conform to the provisions of the AWS Code shall be considered to be prequalified.

B. The welding procedures requiring qualification shall conform to the requirements of AWS D1.1.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Receiving Shop Paint: Receive paint in original, unopened containers bearing paint manufacturer's printed label.
   1. Label shall show manufacturer's name, trade name of paint, Federal Specification compliance (if applicable), shelf life, and date of manufacture.

B. Protection:
   1. Upon delivery to the site, promptly cover and protect steel items (which are not required to receive shop paint) from rusting.
   2. Store shop paint in accordance with paint manufacturer's printed instructions.

1.10 ENVIRONMENTAL REQUIREMENTS FOR SHOP PAINTING

A. Comply with the following conditions for the application of paint unless otherwise stated in the paint manufacturer's printed directions.
1. Minimum ambient, steel surface, and paint temperatures: 40 degrees F.
2. Maximum steel surface temperature: 100 degrees F.
3. Maximum relative humidity: 85 percent.
4. Surface of steel: Dry.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wide Flange Structural Steel: ASTM A-992

B. M and S-Shapes, Channels and Angles: ASTM A 36.

C. HP-Shapes: ASTM A 572, Grade50.

D. Steel plates, bars and rods: ASTM A 36.

E. Anchor Bolts: F1554, Gr. 36 unless otherwise noted on drawings.

F. Steel for Shims and Fillers: ASTM A 569.

G. Exterior Lintels: ASTM A 36, galvanized.

H. High-Strength Threaded Fasteners (High-Strength Bolts): ASTM A 325 heavy hexagon structural bolts, nuts, and hardened washers.

I. Steel Pipe: ASTM A 53, Type E or S, Grade B.

J. Steel Hollow Structural Sections (Round, Square, or Rectangular): ASTM A 500, Grade B; or ASTM A 500, Grade C.

K. Weld Filler Metal:

1. General: Weld filler metal shall be in accordance with Table 4.1.1 of the AWS Code, except as follows:
   a. Only electrode and flux combinations complying with AWS Classifications F7AX-EXXX or F7AX-EXXX-a, (a = B2, Ni1, Ni2, Ni3 or W), shall be used for submerged arc welding.
   b. Only electrode and shielding gas combinations complying with AWS Classifications E 7XT-1 or E 7XT-5 shall be used for flux cored arc welding.
2. Weld filler metal for shielded metal arc, submerged arc, gas metal arc, and flux cored arc welding which conforms to AWS Specifications A5.1 or A5.5 shall be considered to be prequalified.

L. Cold Galvanizing Compound: Single component compound giving 93 percent pure zinc in the dried film, and meeting the requirements of DOD-P-21035A (NAVY).

M. Shop Paint (General): Steel primer selected from the following:

1. TNEMEC 10-99 (Red), 10-99G (Green) or 10-1009 (Gray).
2. Rust-Oleum 769.
3. Valspar 13-R-53.
4. Sherwin-Williams “Kromik”.

N. Shop Paint for Galvanized Steel: FS TT-P-641, Type II.

O. Steel to receive Sprayed-On Fireproofing shall not be shop primed.

P. Shop Paint for Exterior Structural Steel (High-Ratio Water Based Inorganic Zinc Silicate): Steel primer selected from the following:

1. Sherwin Williams ZincClad X1.
2. Carboline Carbozinc 18 WB.

2.02 FABRICATION

A. Progress shop fabrication from “NO EXCEPTIONS TAKEN” detail drawings only.
1. When detail drawings are “NO EXCEPTIONS TAKE” and “MAKE CORRECTIONS NOTED”, progress fabrication in strict accordance with notes thereon.
2. Fabrication progressed from “REJECTED” or “MAKE CORRECTIONS AS NOTED” detail drawings will be rejected. The contractor shall have no claim for any costs or delays due to rejection of items fabricated from “REJECTED” or “MAKE CORRECTIONS AS NOTED” detail drawings.

B. Make provision for connections of other Work, including all cutting and punching of structural members where required by the Drawings, or for which information is furnished prior to approval of the shop drawings.

C. Remove extension bars or run-off plates upon the completion and cooling of groove welds. Grind the ends of the welds smooth and flush with the edges of the abutting parts.

D. Remove tack welds not incorporated into the final weld, and temporary welds. Grind affected surfaces smooth and flush.

E. Detail all fillet welded joints so as to permit the welding electrode or wire to be positioned at a minimum angle of 30 degrees from the face of any material upon which weld metal is to be deposited.

F. Prepare material in accordance with Section 3 of the AWS Code. Do not use gas or air carbon-arc cutting to cut or enlarge bolt holes.

2.03 GALVANIZING

A. Unless otherwise specified or noted, items indicated to be galvanized shall receive a zinc coating by the hot-dip process, after fabrication, complying with the following:
1. ASTM A 123 for plain and fabricated material.
2. ASTM A 153 for iron and steel hardware.

2.04 SHOP PAINTING

A. Thoroughly clean all structural steel. Remove oil, grease, and similar contaminants in accordance with SSPC SP-1 “Solvent Cleaning”. Remove loose mill scale, loose rust, weld slag and spatter, and other detrimental material in accordance with SSPC SP-2 “Hand Tool Cleaning”, SSPC SP-3 “Power Tool Cleaning”, SSPC SP-6“ Commercial Blast Clean” or SSPC SP-7 “Brush-Off Blast Cleaning, or SSPC SP-10 “Near-White Blast Cleaning”.

B. Galvanized Items:
1. Galvanized items which are to be finish painted under Section 099101 shall be rinsed in hot alkali or in an acid solution and then in clear water.
2. Welded and abraded galvanized surfaces shall be wire brushed and repaired with a coating of cold galvanizing compound applied in accordance with compound manufacturer’s instructions.

C. Apply one coat of shop paint to all steel surfaces except as follows:
1. Do not paint steel members designated “NP” on the Drawings.
2. Paint steel surfaces scheduled to be painted that are inaccessible after assembly, except surfaces in contact, with two coats of shop paint before assembly.
3. Do not paint steel surfaces to be field welded, contact surfaces of high-strength bolted slip-critical connections, steel to be encased in cast-in-place concrete, steel receiving sprayed-on fireproofing , and the top flange of beams and girders in composite construction.
4. Do not paint galvanized items which are not to be finish painted under Section 099101.
5. Apply two shop coats of High-Ratio Water Based Inorganic Zinc Silicate to all exterior steel member surfaces.

D. Apply paint and compound to the following minimum thickness per coat:
1. Shop Paint (General): 4.0 mils wet film.
2. Shop Paint for Galvanized Steel: 3.0 mils wet film.
3. Cold Galvanizing Compound: 2.0 mils dry film.
4. Shop Paint (Water-Based Zinc Silicate): 3.0 mils dry film.

PART 3 EXECUTION

3.01 ERECTION

A. Erect steel in accordance with the AISC Specification, the AISC Code, the AWS Code and the Specification for Structural Joints, except as otherwise specified.

B. Prepare and place shrink-resistant grout in accordance with grout manufacturer's printed instructions.
   1. Comply with manufacturer's instructions for preparation of surfaces in contact with the grout, and for curing and protection of the grout.

C. Remove extension bars and run-off plates upon the completion and cooling of groove welds. Grind the ends of the welds smooth and flush with the edges of the abutting parts.

D. Remove tack welds not incorporated into the final weld, and temporary welds. Grind affected surfaces smooth and flush.

E. Do not make corrections or alterations to fabricated steel without prior written approval by the Engineer.

3.02 SCHEDULE OF GALVANIZED STRUCTURAL STEEL

A. In addition to members indicated on the Drawings, hot-dip galvanize structural steel members as indicated below.
   1. All exterior exposed steel.
   2. All loose lintels in exterior walls.
   3. All framing supporting refrigerator/freezer equipment.
   4. Nuts, washers and the top 12 inches of exterior anchor bolts.

B. Two shop coats of High-Ratio Water Based Inorganic Zinc Silicate paint may be substituted in lieu of hot-dip galvanizing.

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceiling joist framing.
2. Soffit framing.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Vertical deflection clips.
3. Single deflection track.
4. Double deflection track.
5. Drift clips.
6. Ceiling joist framing.
7. Soffit framing.
8. Post-installed anchors.
9. Sill sealer gasket.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

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B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

D. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ClarkDietrich.
2. Marino\WARE.
3. Steel Network, Inc. (The).

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and ASTM C955 .

C. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Framing Members, General: Comply with ASTM C955 for conditions indicated.

B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance .
2. Coating: G60 , A60 , AZ50 , or GF30 .

C. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

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1. Grade: As required by structural performance .
2. Coating: G60 .

2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch .
2. Flange Width: 1-5/8 inches , minimum.

2.5 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch .
2. Flange Width: 1-5/8 inches , minimum.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Anchor clips.
4. Gusset plates.
5. Stud kickers and knee braces.
6. Joist hangers and end closures.
7. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

C. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

D. Welding Electrodes: Comply with AWS standards.

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2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M .

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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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. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

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3.4 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: 16 inches .

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.5 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

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E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

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SECTION 075113 - BUILT-UP ASPHALT ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Built-up asphalt roofing.
2. Substrate board.
3. Roof insulation.
4. Materials and application procedures for a unit and curb installation on a built-up roofing system.

B. Section includes the installation of 3 ply flashing at new curb locations. Tie into existing roofing system.

C. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.

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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. 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 affects roofing.
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.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

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B. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

C. Warranties: Special warranties specified in this Section.

1.6 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 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 special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer.

1. Protect stored liquid material from direct sunlight.
2. 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.

1. Store in a dry location.
2. 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.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roofing membrane, base flashings, new curbs, new flashing and other components of roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.

1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746/C3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical to that specified for this Project.

1. ASCE 7 minimum uplift resistance, calculated using a safety factor of 2:
   a. a. Field Zone: 70 psf
   b. b. Perimeter Zones: 115 psf
   c. c. Corner Zone: 175 psf

E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency.

1. Identify products with appropriate markings of applicable testing agency.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Ecology Commercial and Industrial Roofing Systems.
3. Tremco Incorporated.

B. Source Limitations: Obtain components for roofing system from manufacturer approved by roofing membrane manufacturer.

2.3 BASE FLASHING SHEET MATERIALS

A. Ply Sheet: Burmastic Composite Ply HT by Tremco Inc.

B. Cap Sheet: Powerply Standard FR by Tremco Inc.

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C. Liquid Flashing System: Roof membrane manufacturer's standard one- or two-part moisture curing resin with low solvent content, consisting of a primer, flashing cement, and scrim.

2.4 ASPHALT MATERIALS

A. Asphaltic Primer: Tremprime WB by Tremco Inc.

2.5 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing manufacturer for intended use and compatible with other roofing components.

1. Reinforcing Mesh: Burmesh by Tremco Inc.

2. Sealant: Polyroof SF by Tremco Inc

B. Cold Process Adhesive: Powerply Standard Cold by Tremco Inc.

C. Roof Vents: As recommended by roof membrane manufacturer.

1. Size: Not less than 4-inch diameter.

D. Sheathing Paper: Red-rosin type, minimum 3 lb./100 sq. ft.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8-inch-thick; with anchors.

F. Cold-Applied Asphalt Adhesive: ASTM D3019, Type III, roof system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing system and base flashings.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening built-up roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.

H. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roof membrane manufacturer, approved for use in FM Approvals' RoofNav-listed roof assemblies, approved for use in SPRI's Directory of Roof Assemblies listed roof assemblies.

B. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, 1.6-lb/cu. ft. minimum density, 25psi minimum compressive strength, square edged.

1. Thermal Resistance: R-value of 5.0 per inch.
2. Size39
3. Thickness:
   a. Curb insulation: 1 1/2 inches.

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2.7 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate and acceptable to roofing manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.
2. Bead-applied, low-rise, one-component, or multicomponent urethane adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.
5. Verify that minimum concrete drying period recommended by roofing manufacturer has passed.
6. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F2170.
   a. Test Frequency: One test probe per each 1000 sq. ft., or portion thereof, of roof deck, with not less than three test probes.
   b. Submit test reports within 24 hours of performing tests.
7. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.
8. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
9. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
10. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
11. Verify that adjacent cementitious wood fiber panels are vertically aligned to within 1/8-inch at top surface.

B. 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 manufacturer's written instructions.

1. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

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1. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal./100 sq. ft., and allow primer to dry.

D. Perform fastener-pullout tests according to roof system manufacturer's recommendations.

1. Submit test result within 24 hours of performing tests.
   a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

E. Install sound-absorbing insulation strips in ribs of acoustical roof decks according to acoustical roof deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. 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.

1. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

D. Asphalt Heating:

1. Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application.
2. Circulate asphalt during heating.
   a. Do not raise asphalt temperature above equiviscous temperature range more than one hour before time of application.
3. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating.
4. Do not heat asphalt within 25 deg F of flash point.
5. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
   a. Apply hot roofing asphalt within plus or minus 25 deg F of equiviscous temperature.

E. Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing manufacturer's written instructions.

F. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.
   a. Locate end joints over crests of steel roof deck.
2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.

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4. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturer's written instructions.
6. Loosely lay substrate board over roof deck.

B. Using a spud bar remove stone gravel from work areas.

C. Clean and prime existing gravel built up roof with Tremprime WB at 200-400 square feet per gallon and allow to tack.

D. Apply Tremco Powerply Standard Cold adhesive at two gallons per square per ply to existing roof and new units and apply two plies of Burmastic Composite Ply HT into cold adhesive. Broom plies in for clean tight finish.

E. Apply Tremco Powerply Standard Cold adhesive at two gallons per square over newly installed two ply and apply Tremco Powerply Standard FR. Broom in for clean finish.

F. Terminate top of new sheet with termination bar every 6 O.C. and ensure termination bar is counter flashed with slip metal.

G. Run leading edge of new two ply Burmastic Composite Ply HT base plies as well as Powerply Standard FR cap sheet onto existing roof per drawings. Seal leading edge of new flashing system into existing roof in three course fashion using Polyroof SF and Burmesh.

H. Seal veritical laps and corners in three course fashion using Polyroof SF and Burmsh.

I. Push back stone gravel.

J. Pipe and conduit to receive new copper pitch pockets installed to scope above and filled with Tremco pourable sealer once complete.

K. Any large repairs required to roof during removal of old units will be as follows. Scratch stone and prime roof. Install Powerply cold adhesive at 2 gallon per square and embed Composite Ply HT to complete 4 ply system. Seal leading edges of patch in three course per above scope with Polyroof and Burmesh. Flood patch with cold asphalt and embed stone.

3.5 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install one lapped base sheet course and mechanically fasten to substrate according to roofing membrane manufacturer's written instructions.

D. Nailer Strips: Mechanically fasten 4-inch nominal-, width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:

1. 16 feet apart for roof slopes greater than 1 inch per 12 inches but less than 3 inches per 12 inches.

E. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane with vertical surfaces or angle changes greater than 45 deg.

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3.6 INSTALLATION OF FLASHING AND STRIPPING

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches above built-up roofing and 4 inches onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing.

D. Install liquid flashing system according to manufacturer's recommendations.

1. Extend liquid flashing not less than 3 inches in all directions from edges of item being flashed.
2. Embed granules, matching color of roof membrane, into wet compound.

E. Install stripping according to roofing system manufacturer's written instructions, where metal flanges and edgings are set on roofing membrane.

1. Flashing Sheet Stripping: Install flashing sheet stripping in a continuous coating of asphalt roofing cement, in a solid mopping of hot roofing asphalt applied at not less than 425 deg F, and extend onto roofing membrane, in cold-applied adhesive, or in cold-applied polymer-modified adhesive.

3.7 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing components that do not comply with requirements, repair substrates, and repair or reinstall roofing 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 075113

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed equipment support flashing.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.

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2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches .

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

B. Special warranty.

1.8 QUALITY ASSURANCE

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with and requirements for dimensions and profiles shown unless more stringent requirements are indicated.

2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. As-Milled Finish: Mill .

2.3 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal 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. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
4. Fasteners for Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

F. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

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2.4 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.5 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws .

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

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1. Use sealant-filled joints unless otherwise indicated.
   a. Embed hooked flanges of joint members not less than 1 inch into sealant.
   b. Form joints to completely conceal sealant.
   c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
   d. Adjust setting proportionately for installation at higher ambient temperatures.
      1) Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder metallic-coated steel and aluminum sheet.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.4 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.6 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

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SECTION 077200 - ROOF 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. Roof curbs.

B. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

D. Delegated-Design Submittal: For roof curbs 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 mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

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1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design roof curbs and equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported See drawings for list of HVAC unit weights. .

D. Material: Zinc-coated (galvanized) steel sheet, as required by curb engineer sufficient thickness to support unit loads.

1. Finish: Baked enamel or powder coat .
2. Color: As selected by Architect from manufacturer's full range .

E. Construction:

1. Curb Profile: Profile as indicated on Drawings compatible with roofing system.
2. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
3. Top Surface: Level top of curb, with roof slope accommodated by use of leveler frame.
4. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
5. Liner: Same material as curb, of manufacturer's standard thickness and finish.
6. Nailer: Factory-installed wood nailer under top flange on side of curb, continuous around curb perimeter.

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7. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
8. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
9. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.3 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation and mill phosphatized for field painting where indicated.

1. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 coated.

1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

C. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

D. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

E. Steel Tube: ASTM A500/A500M, round tube.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Underlayment:

1. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D4397.
3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.

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4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

I. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

J. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.

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3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

F. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

G. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

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SECTION 078413 - PENETRATION FIRESTOPPING

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. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Requirements:

1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

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1.7 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."

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
        1) UL in its "Fire Resistance Directory."
        2) FM Global in its "Building Materials Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, 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: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

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D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

F. 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 system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. 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 sleeve lined with an intumescent strip, a 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 intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

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. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system 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.

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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: Before installing penetration firestopping systems, clean out openings immediately 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 materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. 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.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

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.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
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. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-

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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 according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems 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 system 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 systems are 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 material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

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SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated construction.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data:

1. Joints in or between fire-resistance-rated construction.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

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1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with Listed System Designs published by a qualified testing agency.
        1) UL in its online directory "Product iQ."

B. Rain/Water Resistance: For perimeter fire-barrier system applications, where inclement weather or greater-than-transient water exposure is expected, use products that dry rapidly and cure in the presence of atmospheric moisture sufficient to pass ASTM D6904 early rain-resistance test (24-hour exposure).

2.3 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
3. Provide firestop products that do not contain ethylene glycol.

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B. Intumescent Gypsum Wall Framing Gaskets (Applied to Steel Tracks, Runners, and Studs prior to Framing Installation): Provide products with fire, smoke, and acoustical ratings that allow movement up to 100 percent compression and/or extension in accordance with UL 2079 or ASTM E1966; have an L Rating less than 1 cfm/ft. in accordance with UL 2079; and a minimum Sound Transmission Class (STC) rating of 56 in accordance with ASTM E90 or ASTM C919.

C. For aluminum curtain-wall assemblies with one- or two-piece rectangular mullions at least 2-1/2 by 5 inches, provide perimeter fire-barrier system that does not require direct screw attachment to mullions and transoms to support and fasten curtain-wall insulation. System to be tested in accordance with ASTM E2307 for up to 2-hour fire resistance and with ASTM E1233 for wind cycling equivalent to 108 mph wind for 500 cycles.

D. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. 3M Fire Protection Services.
   b. Hilti, Inc.
   c. Owens Corning.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

E. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E2307.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. 3M Fire Protection Services.
   b. Hilti, Inc.
   c. Owens Corning.
2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

F. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. 3M Fire Protection Services.
   b. Hilti, Inc.
   c. Owens Corning.
2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

G. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

2.4 ACCESSORIES

A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 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.

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3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately 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 elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping 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. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition occurs, such as the intersection of a gypsum wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.

3.3 INSTALLATION

A. General: Install joint firestopping 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 elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. from end of wall and at intervals not exceeding 30 ft..

B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.

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6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections in accordance with ASTM E2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping 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 joint firestopping 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 joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's online directory "Product iQ" under product Category XHBN or Category XHDG.

B. Floor-to-Floor, Joint Firestopping Systems: .

1. Assembly Rating: 1 hour 2 hours .
2. Nominal Joint Width: As indicated .
3. Movement Capabilities: Class II - percent compression or extension .
4. W-Rating: No leakage of water at completion of water leakage testing.

C. Wall-to-Wall, Joint Firestopping Systems: .

1. UL-Classified Systems: WW- D - .
2. Assembly Rating: 1 hour 2 hours .
3. Nominal Joint Width: As indicated .
4. Movement Capabilities: Class II - percent compression or extension.

D. Floor-to-Wall, Joint Firestopping Systems: .

1. UL-Classified Systems: FW- D - .
2. Assembly Rating: 1 hour 2 hours .
3. Nominal Joint Width: As indicated .
4. Movement Capabilities: Class II - percent compression or extension .

E. Head-of-Wall, Fire-Resistive Joint Firestopping Systems: .

1. UL-Classified Systems: HW- D - .
2. Assembly Rating: 1 hour 2 hours .
3. Nominal Joint Width: As indicated .
4. Movement Capabilities: Class II - percent compression or extension.

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F. Perimeter Joint Firestopping Systems: .

1. UL-Classified Perimeter Fire-Containment Systems: CW- D - .
2. Integrity Rating: 1 hour 2 hours .
3. Movement Capabilities: Class II - percent compression or extension.
4. F-Rating: 1 hour 2 hours .

END OF SECTION 078443

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Polysulfide joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Polysulfide joint sealants.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

B. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

1.6 QUALITY ASSURANCE

1.7 MOCKUPS

A. 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.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

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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.

1.9 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. 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 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer.

2.2 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. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

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2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.6 POLYSULFIDE JOINT SEALANTS

A. Polysulfide, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.

B. Polysulfide, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

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.
    c. .
3. Remove laitance and form-release agents from concrete.
4. 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. .

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.

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B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type 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 in accordance with 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 in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings in accordance with Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings in accordance with Figure 8C in ASTM C1193.
    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
    a. Extent of Testing: Test completed and cured sealant joints as follows:
        1) Perform 10 tests for the first 1000 ft. of joint length for each kind of sealant and joint substrate.
        2) Perform one test for each 1000 ft. of joint length thereafter or one test per each floor per elevation.
    b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
    c. Inspect tested joints and report on the following:
        1) Whether sealants filled joint cavities and are free of voids.
        2) Whether sealant dimensions and configurations comply with specified requirements.
        3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
    d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

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e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

2. 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.

C. Prepare test and inspection reports.

3.5 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.

3.6 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.

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SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-rated access doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details , fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Product Schedule: For access doors and frames.

1.3 INFORMATIONAL SUBMITTALS

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies meets the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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a. ACUDOR Products, Inc.
b. Babcock-Davis.
c. Metropolitan Door Industries Corp.

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal ; with exposed flange, self-closing door, and concealed hinge.
3. Optional Features: Upward-opening doors for ceilings .
4. Locations: Ceiling .
5. Door Size: 24" x 24" .
6. Fire-Resistance Rating: Not less than 45 minutes .
7. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
8. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch , 20 gage , factory finished.
9. Frame Material: Same material, thickness, and finish as door .
10. Latch and Lock: Self-latching door hardware, operated by knurled-knob with interior release.

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Aluminum Extrusions: ASTM B221, Alloy 6063.

E. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

F. Frame Anchors: Same material as door face.

G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

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F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.
    a. Color: As indicated by manufacturer's designations .

E. Stainless Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
    a. Run grain of directional finishes with long dimension of each piece.
    b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates 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. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.2 ACTION SUBMITTALS

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association .

1.5 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. .

B. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

C. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.

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2.2 FRAMING SYSTEMS

A. Studs and Track: ASTM C645 .

1. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection .
2. Depth: As indicated on Drawings .

B. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Track System: ASTM C645 top track with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
3. Deflection Track: Steel sheet top track 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.

C. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of 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.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: As indicated on Drawings .

E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel 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.

F. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Minimum Base-Steel Thickness: As indicated on Drawings .
2. Depth: As indicated on Drawings .

G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: hat shaped.

H. 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 steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

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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 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 are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. 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.

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1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 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 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 that penetrate 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 track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs at each jamb unless otherwise indicated.
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: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Mold-resistant gypsum board.
4. Glass-mat, water-resistant backing board.
5. Cementitious backer units.
6. Water-resistant gypsum backing board.
7. Interior trim.
8. Joint treatment materials.
9. Laminating adhesive.

B. Samples for Initial Selection: For each type of trim accessory indicated.

1.3 MOCKUPS

A. Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:
   a. Each level of gypsum board finish indicated for use in exposed locations.
2. 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.

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1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. 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 BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: As indicated on Drawings .
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

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2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet .
2. Shapes:
   a. Cornerbead.
   b. Bullnose bead.
   c. LC-Bead: J-shaped; exposed long flange receives joint compound.
   d. L-Bead: L-shaped; exposed long flange receives joint compound.
   e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   f. Expansion (control) joint.
   g. Curved-Edge Cornerbead: With notched or flexible flanges.
   h. Base-of-Wall Galvanized Moisture Barrier Trim: Galvanized-steel sheet, 2 inches high.
   i. Base-of-Wall PVC Moisture Barrier Trim: Extruded PVC, 1-3/4 inch high.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc .
2. Shapes:
   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound.
   c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

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.

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 drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

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1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

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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 C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings .
2. Type X: Where required for fire-resistance-rated assembly .
3. 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. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws .

3.4 FINISHING OF 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.

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C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated .
   a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.5 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

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SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied finishes.

D. Delegated-Design Submittal: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials , from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

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1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS

A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

B. Classification: Provide panels as follows:

1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 1, nodular; with glass-fiber cloth overlay.
2. Pattern: E (lightly textured) .

C. Color: White .

D. Light Reflectance (LR): Not less than 0.85 .

E. Ceiling Attenuation Class (CAC): Not less than 35 .

F. Noise Reduction Coefficient (NRC): Not less than 0.80 .

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G. Articulation Class (AC): Not less than 190 .

H. Edge/Joint Detail: Square Flush reveal sized to fit flange of exposed suspension-system members Beveled, kerfed, and rabbeted long edges and square, butt-on short edges .

I. Thickness: As indicated in a schedule .

J. Modular Size: As indicated on Drawings .

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.

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, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Intermediate -duty system.
2. End Condition of Cross Runners: butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel .
5. Cap Finish: Painted white .

2.5 ACCESSORIES

A. 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.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
   a. Type: Postinstalled expansion anchors.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for 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 not less than 0.135-inch- diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

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F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member .
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M , seismic design requirements, and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

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2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. 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. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. 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 precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. As indicated on reflected ceiling plans.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. 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.
5. 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.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet , non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet , non-cumulative.

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3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

3.6 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.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Thermoset-rubber base.
2. Rubber molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials , from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 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.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .

C. Install resilient products after other finishing operations, including painting, have been completed.

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PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

A. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:
   a. Style B, Cove: Provide in areas with resilient floor coverings .

B. Thickness: 0.125 inch.

C. Height: 4 inches .

D. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

E. Outside Corners: Preformed .

F. Inside Corners: Preformed .

G. Colors: As indicated by manufacturer's designations .

2.2 RUBBER MOLDING ACCESSORY

A. Description: Rubber transition strips .

B. Profile and Dimensions: As indicated .

C. Locations: Provide rubber molding accessories in areas indicated .

D. Colors and Patterns: As indicated by manufacturer's designations .

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 resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test: 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. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

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1. Tightly adhere to substrates throughout length of each piece.
2. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.

1. Apply one coat(s).

E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

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SECTION 096519 - RESILIENT TILE FLOORING

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. Vinyl composition floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full-size units of each color, texture, 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.

1.4 INFORMATIONAL SUBMITTALS

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials , from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors 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.

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1.8 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.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .

C. 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 floor tile, 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.

2.2 VINYL COMPOSITION FLOOR TILE

A. Tile Standard: ASTM F 1066, Class 2, through pattern .

B. Wearing Surface: Smooth .

C. Thickness: 0.125 inch .

D. Size: 12 by 12 inches.

E. Colors and Patterns: to be selected from manufactures standard colors .

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.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

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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. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test: 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. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as 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.

1. Lay tiles square with room axis .

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.

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1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern) .

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. Adhere floor tiles to 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.

H. Resilient Terrazzo Accessories: Install according to manufacturer's written instructions.

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 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. Cover floor tile until Substantial Completion.

END OF SECTION 096519

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SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Primers.
2. Water-based finish coatings.
3. Solvent-based finish coatings.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
2. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
   b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

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3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply 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 of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range .

1. Ten percent of surface area will be painted with deep tones.

2.3 PRIMERS

A. Interior/Exterior Latex Block Filler: Water-based, high-solids, emulsion coating formulated to bridge and fill porous surfaces of exterior concrete masonry units in preparation for specified subsequent coatings.

B. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.

C. Interior Alkyd Primer Sealer: Solvent-based, alkyd-type, primer/sealer for new interior wood, plaster, and porous surfaces,

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2.4 WATER-BASED FINISH COATS

A. Interior, Latex, Flat: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Gloss and Sheen Level: Maximum gloss of five units at 60 degrees and maximum sheen of 10 units at 85 degrees when tested in accordance with ASTM D523 .

B. Interior, Latex, Low Sheen: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Gloss and Sheen Level: Maximum gloss of 10 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523 .

C. Interior, Latex, Eggshell: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Gloss and Sheen Level: Gloss of 10 to 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523 .

D. Interior, Latex, Satin: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Gloss and Sheen Level: Gloss of 20 to 35 units at 60 degrees and minimum sheen of 35 units at 85 degrees when tested in accordance with ASTM D523 .

E. Interior, Latex, Semigloss: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Gloss Level: Gloss of 35 to 70 units at 60 degrees when tested in accordance with ASTM D523 .

F. Interior, Latex, Gloss: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Gloss Level: Gloss of 70 to 85 units at 60 degrees when tested in accordance with ASTM D523 .

2.5 SOLVENT-BASED FINISH COATS

A. Interior, Alkyd, Eggshell: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.

1. Gloss and Sheen Level: Gloss of 10 to 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523 .

B. Interior, Alkyd, Semigloss: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.

1. Gloss Level: Gloss of 35 to 70 units at 60 degrees when tested in accordance with ASTM D523 .

C. Interior, Alkyd, Gloss: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.

1. Gloss Level: Gloss of 70 to 85 units at 60 degrees when tested in accordance with ASTM D523 .

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems 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. 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.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2.

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2. SSPC-SP 7/NACE No. 4.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. 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.

K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

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. Uninsulated metal piping.
   b. Uninsulated plastic piping.
   c. Pipe hangers and supports.
   d. Metal conduit.
   e. Plastic conduit.
   f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   g. .
2. Paint the following work where exposed in occupied spaces:

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a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Metal conduit.
e. Plastic conduit.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Other items as directed by Architect.
h. .

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

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.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. High-Performance Architectural Latex System :
   a. Block Filler: Interior/exterior latex block filler.
   b. Prime Coat: Alkali-resistant, water-based primer.
   c. Intermediate Coat: Matching topcoat.
   d. Topcoat: Interior, latex, high-performance architectural coating, .

B. Steel Substrates:

1. Alkyd System :
   a. Prime Coat: .
   b. Intermediate Coat: Matching topcoat.
   c. Topcoat: Interior, alkyd, eggshell semigloss gloss.

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2. Alkyd over Surface-Tolerant Primer System :
   a. Prime Coat: Surface-tolerant metal primer.
   b. Intermediate Coat: Matching topcoat.
   c. Topcoat: Interior, alkyd, eggshell semigloss gloss.

C. Galvanized-Metal Substrates:

1. Alkyd over Cementitious Primer System :
   a. Prime Coat: Cementitious galvanized primer.
   b. Intermediate Coat: Matching topcoat.
   c. Topcoat: Interior, alkyd, eggshell semigloss gloss.

D. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Alkyd System :
   a. Prime Coat: Primer, .
   b. Intermediate Coat: Matching topcoat.
   c. Topcoat: Interior, alkyd, eggshell semigloss .

E. Gypsum Board and Plaster Substrates:

1. Latex over Latex Sealer System :
   a. Prime Coat: Interior latex primer sealer.
   b. Intermediate Coat: Matching topcoat.
   c. Topcoat: Interior, latex, flat low sheen eggshell satin semigloss gloss.

F. Insulation-Covering Substrates: Including .

END OF SECTION 099123

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SECTION 230500 COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Division 1 Sections for requirements in selecting products and requesting substitutions.

1.02 SCOPE OF WORK

A. The following is a general listing of work items to be provided under this Contract. Work indicated is not necessarily all inclusive, nor shall it limit the extent of the work or exclude any work shown or specified and not listed. Refer to drawings FES-M-001 and WGES-M-001 for summaries of work.

B. Work as indicated in the contract documents and as specified, including but not limited to the complete removal of material and equipment from the site.

C. Furnish and install materials, equipment, and labor for a complete installation a specified in these contract documents.

1.03 PRODUCT LISTING

A. Prepare a listing of major equipment and materials for the project. Submit this listing for approval.

B. When two or more items of same material or equipment are required (pumps, valves, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings, sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.

C. Provide products which are compatible within systems and other connected items.

1.04 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.06 DIMENSIONAL INFORMATION

A. Dimensional information used for layout and locations shall be taken from architectural or structural drawings used by the construction trades.

B. HVAC drawings are diagrammatic and have no dimensional significance. Do not scale. Locations of equipment and piping are to be as:

1. Shown on the drawings;
2. Directed in the field;
3. Required for proper connection of equipment to be served;
4. Required for proper symmetry in the space involved;
5. With deviations made only with specific approval of Owner.

C. Review the drawings of other trades and contractors, exchange shop drawings with them, cooperate in the preparation or prepare space layouts as required, to avoid conflicts and interferences with the installation of other trades in advanced stages of construction.

D. Field verify all existing conditions and coordinate with other trades prior to fabrication and installation of equipment and material. Lack of field verification does not constitute a basis for additional monies during construction. Contractor assumes full responsibility for completeness of installation including coordination of work with other trades.

E. Materials and equipment shall be shipped to the site knocked down to fit through existing building openings. Field verify the dimensions of existing openings and verify methods of delivery of materials and equipment prior to fabrication. Include in the bid price all costs associated with the disassembling and reassembling materials and equipment as required for delivery and installation.

1.07 SUBMITTALS

A. Submit manufacturer's technical product data and installation instructions for materials and products.

B. Record Drawings: At project closeout, submit record drawings of the installed work; in accordance with requirements of Division 1.

1.08 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance manuals for all equipment and materials specified herein.

B. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.

C. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions.

D. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

E. Servicing instructions and lubrication charts and schedules.

1.09 WARRANTIES

A. Refer to Division l for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND CLEARANCES

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

B. Maintain working space as required by NEC 110.26 for live electrical components as follows:
   a. Width: 30”
   b. Height: 6’-6” or height of equipment.
   c. Depth:
      i. 0-150V to ground: 3’-0”
      ii. 151-600V to ground, insulated/ungrounded parts other side: 3’-0”
      iii. 151-600V to ground, grounded parts other side: 3’-6”
      iv. 151-600V to ground, live parts both sides: 4’-0”

3.02 INSTALLATIONS

A. Coordinate equipment and materials installation with other building components.

B. Verify all dimensions by field measurements.

C. Arrange for chases and openings in other building components to allow for installations.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.

F. Coordinate the cutting and patching of building components to accommodate the installation of equipment and materials.

G. Where mounting heights are not detailed or dimensioned, install overhead and materials to provide the maximum headroom possible.

H. Install equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

I. Coordinate the installation of materials and equipment above ceilings with suspension system, light fixtures, and other installations.

J. Coordinate connection of systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations and controlling agencies. Provide required connection for each service.

3.03 CUTTING AND PATCHING

A. This Article specifies the cutting and patching of equipment, components, and materials to include removal and legal disposal of selected materials, components, and equipment.

B. Refer to the Division 1 Sections for general requirements for cutting and patching.

C. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, because of damage caused as a result of the installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work;
2. Remove and replace defective work;
3. Remove and replace work not conforming to requirements of the contract documents;
4. Remove samples of installed work as specified for testing;
5. Install equipment and materials in existing structures;
6. Upon written instructions from the Owner, uncover and restore work to provide

for the Owner's observation of concealed work.

G. Cut, remove and legally dispose of selected equipment, components, and materials as indicated, including, but not limited to removal of piping, valves, trim, and other items made obsolete by the new work.

H. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

J. Locate, identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to changeover.

END OF SECTION 230500

SECTION 230523 - VALVES

PART 1 GENERAL

1.01 ABBREVIATIONS

A. IBBM: Iron body, bronze mounted.

B. OS&Y: Outside screw and yoke.

C. WOG: Water, oil, gas.

D. WSP: Working steam pressure.

1.02 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions for each valve type.

B. Valve Schedule: List type of valve, manufacturer’s model number, and size for each service application.

C. Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.04 MAINTENANCE

A. Special Tools:
1. One wrench for each type and size wrench operated plug valve.
2. Two insert changing tools, and one spare insert for each self contained thermostatic radiator control valve.

PART 2 PRODUCTS

2.01 VALVES - GENERAL

A. Valve Standardization: Valves from one or more manufacturers may be used, however valves supplied for each specific valve type shall be the product of one manufacturer.

B. Valves shall be first quality, free from all imperfections and defects, with body markings indicating manufacturer and rating.

C. Valve parts of same manufacturer, size and type shall be interchangeable.

D. Manually operated gate, globe and angle valves shall be of rising stem type, unless otherwise specified.

E. Manually operated valves shall open in a counterclockwise direction by means of round ventilated type handwheels.
   1. Exception: Cross handle type handwheels are acceptable for valves up to 3 inches in size.

F. In open position, wedge and stem of gate valves shall clear the waterway completely.

G. Valves which use packing shall be capable of being packed when wide open and under full working pressure.

H. Size valves the same size as the piping in which they are installed, unless otherwise specified.

I. Provide manually operated gate and globe valves 8 inches in size and larger with valved by-pass incorporated in body of main valve when installed in piping systems operating at a pressure in excess of 125 psig WSP and as shown on the drawings. Service rating of by-pass valve shall be equal to or greater than main valve it is by-passing.
   1. Exception: Stop-check valves.

2.02 MATERIALS

A. Body:
   1. Cast Iron: ASTM A 126 66, Class B, higher strength cast iron.
   2. Bronze: For use up to 150 psig WSP, ASTM B 62 and over 150 psig to 300 psig WSP, ASTM B 61.
   3. Cast Steel: ASTM A 216 Grade WCB.
   4. Forged Steel: ASTM A 105 Grade 2.

B. Stem:
   1. Cast Manganese Bronze: ASTM B 584.
   2. Cast Silicon Brass: ASTM B 584.
   3. Rolled Silicon Brass: ASTM B 98 Alloy D.
   4. Rolled Aluminum Bronze: ASTM B 150 Alloy 1.
   5. Rolled Manganese Bronze: ASTM B 138 Alloy A (half hard).
   6. Naval Brass: ASTM B 21 Alloy A or Alloy C (hard).
   7. Carbon Steel: As specified for particular type of valve.
   8. Stainless Steel: As specified for particular type of valve.

C. Trim: As specified for particular type of valve.

2.03 GATE VALVES

A. Type A: 125 psig WSP, 200 psig WOG, bronze body, union bonnet, solid wedge disc, and threaded ends. Acceptable Valves: Crane428UB, Hammond IB617, Jenkins 47CU, Milwaukee 1152, Nibco T134, and Stockham B105.

B. Type C: 125 psig WSP, 200 psig WOG up to 12 inch size, and 150 psig WOG for 14 inch and 16 inch sizes; IBBM OS&Y, bolted bonnet, solid wedge disc, and threaded or flanged ends depending on size. Acceptable Valves: Crane 464-1/2

& 465-1/2, Hammond IR1140, Milwaukee F2885, Nibco T6170 & F6170, and Stockham G620 & G623

C. Type D: 125 psig WSP, 200 psig WOG, bronze body, threaded bonnet, solid wedge disc, and solder ends. Acceptable Valves: Crane 1330, Hammond IB635, Jenkins 991AJ, Milwaukee 149, Nibco S111, and Stockham B108.

D. Type E: 200 psig WSP, 400 psig WOG, bronze body, union or bolted bonnet, solid wedge disc, with monel, cupro-nickel alloy or stainless steel seat rings, and threaded ends. Acceptable Valves: Crane 424, Hammond IB650, Jenkins 2270UJ, Milwaukee 1174, Nibco T174SS, and Stockham B132.

E. Type G: 300 psig WSP, 600 psig WOG, bronze body, union or bolted bonnet, solid wedge disc, cupro-nickel alloy or stainless steel seat rings, and threaded ends. Acceptable Valves: Crane 634E, Hammond IB658, Jenkins 2280UJ, Milwaukee 1184, Nibco T174SS, and Stockham B145.

2.04 GLOBE AND ANGLE VALVES

A. Type J: 125 WSP, 200 psig WOG, bronze body, threaded bonnet, and threaded ends. Acceptable Valves: Crane 1, Hammond IB440 & IB463, Jenkins 101J, Milwaukee 502, Nibco T211 & T311, and Stockham B16.

B. Type K: 125 psig WSP, 200 psig WOG, IBBM OS&Y, bolted bonnet, and threaded or flanged ends depending on size. Acceptable Valves: Crane 351 & 353, Hammond IR116, Jenkins 613C & 615C, Milwaukee F2981, Nibco F718B & F818B, and Stockham G512, & G515.

C. Type M: 250 psig WSP, 500 psig WOG, IBBM OS&Y, bolted bonnet, renewable seat and disc, and threaded or flanged ends depending on size. Acceptable Valves: Crane 21E, Hammond IR313, Jenkins 923C, Milwaukee F2983, Nibco F768B & F869B, and Stockham F532.

D. Type N: 300 psig WSP, 600 psig WOG, bronze body, union bonnet, with 500 Brinell hardness stainless steel renewable plug, 500 Brinell hardness stainless steel replaceable seat ring, and threaded or flanged ends depending on size. Acceptable Valves: Crane 382P & 384P, Hammond IB444, Jenkins 556P & 558P, Milwaukee 593A, Nibco T276AP & T376AP, and Stockham B74 & B274.

E. Type O: 125 psig, 200 psig WOG, bronze body, threaded bonnet, and solder ends. Acceptable Valves: Crane 1310, Hammond IB423, Jenkins 1200C, Milwaukee 1502, Nibco S211, and Stockham B17.

2.05 CHECK VALVES

A. Type S: 125 psig WSP, 200 psig WOG, bronze body, brass or bronze trim, horizontal swing, renewable and regrindable disc, and threaded ends. Face discs for cold water service with teflon. Acceptable Valves: Crane 37, Hammond IB940, Jenkins 4092, Milwaukee 509, Nibco T413Y, and Stockham B319Y.

B. Type T: 150 psig WSP, 300 psig WOG, bronze body, brass or bronze trim, horizontal swing, renewable and regrindable disc, and threaded ends. Face discs for cold water service with Buna-N or teflon. Acceptable Valves: Crane 137, Hammond IB944, Jenkins 4092 & 4037J, Nibco T4331, and Stockham B321.

C. Type U: 125 psig WSP, 200 psig WOG, bronze body, brass or bronze trim, horizontal swing, renewable and regrindable disc, and solder ends. Face discs for cold water service with teflon. Acceptable Valves: Crane 1340, Hammond IB912, Jenkins 4093, Milwaukee 1509, Nibco S413Y, and Stockham 309Y.

D. Type V: 125 psig WSP, 200 psig WOG, IBBM, horizontal swing, bolted bonnet, regrindable and renewable seat ring and disc, and threaded or flanged ends depending on size. Discs on valves 4 inch size and larger may be cast iron with bronze face. Acceptable Valves: Crane 372, & 373, Hammond IR1124, Jenkins 623CJ & 624CJ, Milwaukee F2974, Nibco F918, and Stockham G927 & G931.

E. Type W:
   1. Globe Style Silent Check Valve: IBBM or semi-steel with bronze mounting, renewable seat and disc, 18-8 stainless steel spring, and flanged ends.
      a. Acceptable Valves (125 psig flange pressure rating): Apco Series 600, Combination Pump & Valve 20D, Hammond IR9354, Milwaukee 1800, Nibco F910, and Williams Hager 636.
      b. Acceptable Valves (250 psig flange pressure rating): Apco Series 600, Combination Pump & Valve 21D, Milwaukee 1800, Nibco F960, and Williams Hager 636.
   2. Wafer Style Silent Check Valve: IBBM or semi-steel with bronze mounting, renewable seat and disc, 18-8 stainless steel spring, and flanged ends.
      a. Acceptable Valves (125 psig flange pressure rating): Apco Series 300, Combination Pump and Valve 10D, Hammond IR9253, Milwaukee 1400, Nibco W910, and Williams Hager 329 & 375.
      b. Acceptable Valves (250 psig flange pressure rating): Apco Series 300, Combination Pump and Valve 11D, Milwaukee 1400, Nibco W960, and Williams Hager 329 & 375.

F. Type X: 300 WSP, 600 psig WOG, bronze body, brass or bronze trim, horizontal swing, renewable and regrindable disc, and threaded ends. Face disc for cold water service with Buna-N or teflon. Acceptable Valves: Crane 76E, Hammond IB949, Jenkins 4962J, Milwaukee 507, Nibco T4731, and Stockham B375.

G. Type Y: 250 psig WSP, 500 psig WOG, IBBM, horizontal swing, bolted bonnet, regrindable and renewable seat ring and disc, and threaded or flanged ends depending on size. Discs on valves 4 inch size and larger may be cast iron with bronze face. Acceptable Valves: Crane 39E, Hammond IR322, Jenkins 339C, Milwaukee F2970, Nibco F968B, and Stockham F947.

H. Type Z: 125 psig flange pressure rating, cast iron body, wafer style, split clapper plate type with integral body seat ring, plain or flat face end connections, resilient Buna-N seal vulcanized to body seat ring; aluminum, bronze or stainless steel

clapper plates; Type 316 stainless steel clapper springs and hinge pins; and nickel plated steel or stainless steel stop pieces. Acceptable Valves: Apco Series 9000, Nibco W920W, Stockham WG970, and Marlin Duo-Check II.

2.06 PLUG VALVES

A. Type AA: 200 psig WOG, lubricated type with standard port opening, cast iron or semi-steel body, sealed lubrication system with lubricant fitting and dial indicator, cylindrical plug or teflon tapered plug, lubricant grooves in body or plug, threaded or flanged ends depending on size, and capable of lubrication with valve under pressure and plug in any position.
   1. Acceptable Valves:
      a. 1/2 inch to 3 inch size: Homestead 611 & 612, Resun R1430 & R1431, and Rockwell 142 & 143.
      b. 4 inch size: Homestead 611 & 612, , Resun R1430 & R1431, and Rockwell 142 & 143.
      c. 5 inch size: Homestead 611 & 612, Resun R1431, and Rockwell 143.
      d. 6 inch size: Homestead 611 & 612, , Resun R1431, and Rockwell 143.
      e. 8, 10 & 12 inch sizes: Homestead 612G, Resun R1431WGA, and Rockwell 149.
   2. Operators:
      a. 6 inch size and Less: Wrench operator.
      b. 8 inch size and Up: Worm gear operator.

B. Type AB: 100 psig WOG, gas cock type with cast iron or bronze body, bronze plug, square head, wrench operator, and threaded ends. Acceptable Manufacturers: Crane, Eclipse Combustion, and McDonald.

2.07 BUTTERFLY VALVES

A. Type BF: Iron body, flangeless wafer or lugged type, (lug for each bolt hole, drilled and tapped for cap screws), with replaceable reinforced resilient EPT (EPDM) seats, bronze or nickel plated ductile iron discs, phosphate coated steel or stainless steel stems, and raised necks able to accommodate 2 inches of insulation. Acceptable Manufacturers: Crane, Demco, De Zurik, Hammond, Keystone, Milwaukee, Nibco, Stockham, and Watts.
   1. Pressure Ratings:
      a. 12 inch size and Less: 200 psig WOG at 275 degrees F.
      b. 14 inch size and Up: 150 psig WOG at 275 degrees F.

B. Type BF-HP: ANSI Class 150 lug style carbon steel body, stainless steel disc and stem, RTFE seats and bushings. Acceptable Manufacturers: Crane, Hammond, Keystone, Milwaukee, and Stockham.

C. Operators:
   1. 6 inch size and Less: Manual actuator handles with external indication of disc position, and suitable means of locking actuator in any fixed position.
   2. 8 inch size and Up: Worm gear operator.

2.08 COMBINATION BALANCING AND SHUT-OFF VALVES

A. Heavy duty brass construction of angle or straightway pattern with 200 psig working water pressure at 250 degrees F, one union connection and one threaded or solder end, visible graduated dial indicator, memory stop, and wheel handle with full turn opening. Acceptable Manufacturers: Dunham-Bush, and Spirax Sarco.

2.09 REFRIGERANT VALVES

A. Type BVR Refrigerant ball valve: Full port, hermetically welded, forged brass with copper tube extensions intended for use with refrigerants specified, teflon seats, polished brass ball, teflon seals, and flared or brazed ends. 500 psig CWP, UL listed. Provide with access fitting. Acceptable Manufacturers: Mitsubishi, Daikin, Apollo 79 series, or equal.

2.10 WATER PRESSURE REDUCING VALVES

A. Cold Water Make-Up Service:
   1. Adjustable direct acting, spring loaded, diaphragm operated, single seat type conforming to ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Supply Systems. Acceptable Manufacturers: Bell & Gossett, Watts, and Wilkins.
      a. Body: Brass or bronze construction.
      b. Wetted Parts: Brass, bronze, stainless steel, or nickel alloy construction.
      c. Renewable seat and removable composition disc.
      d. Integral low inlet pressure check valve.
      e. Operating Temperature Range: 33-160 degrees F.
      f. Maximum Working Pressure: 125 psi.
   2. Pressure reducing valves with integral strainers may be substituted for approval, in lieu of separate valve and strainer, if integral strainer and valve meet individual valve and strainer specifications.

2.12 NEEDLE STOP VALVES

A. For Temperatures to 300 degrees F.: All brass or forged carbon steel construction, union bonnet, screwed ends, built for 1000 psi at 300 degrees F.

B. For Temperature in Excess of 300 degrees F.: Carbon steel bar stock bodies, stainless steel stems, screwed ends, built for 4,500 psi at 450 degrees F.

C. For Use In High Temperature Water Piping: Carbon steel bar stock or forged steel bodies, stainless steel stems, screwed ends, built for 4,500 psi at 450 degrees F.

D. Acceptable Manufacturers: Marsh Instrument Company, Singer-American Meter Division, H.O. Trerice Co. and Weksler Instruments Corp.

2.13 GAGE COCKS

A. Gage Cocks: All brass construction, "T" or lever handles, screwed ends, built for 300 psig hydraulic pressure. Acceptable Manufacturers: Marsh Instrument Company, Mueller Instruments Co., H.O. Trerice Co. and Weksler Instruments Corp.

2.14 GROOVED END VALVES

A. Valves shall be of type, material and pressure rating, as required by the particular application, as approved.

2.15 VACUUM RELIEF VALVES

A. For Use With Water: Watts Regulator Co. No. N36.

2.16 BALL VALVES

A. Type BV: 150 psig WSP, 600 psig WOG, 2-piece full port, bronze body, solid blow-out proof stem, teflon seats, chrome plated brass ball, teflon seals, corrosion resistant steel lever handles with vinyl grips and threaded, solder, or press-fit ends. Acceptable Manufacturers: Apollo, Hammond, Milwaukee, Nibco, and Watts.
1. Valve Option: Extended Stem.
2. Ball Valves for Press-fit Copper Fittings shall be two-piece bronze or brass body with full port, chrome or brass plated ball, blow-out proof stem and PTFE or RTFE seats, rated at 250 psi minimum with press fitting ends. Ball Valves shall be Viega Model 2970.10, NIBCO PC585-70; Apollo Valves 77W-140 Series or Jomar Valve JP-100. Ball valves shall have a metal lever handle.

2.17 SELF CONTAINED THERMOSTATIC RADIATOR CONTROL VALVE

A. Type: NPT Nickel-plated forged brass body with union outlet, EPDM disc, stainless steel spindle, replaceable insert, actuators capable of being changed without draining the system, valve mounted setting knob and remote temperature sensor (46 - 80 Degree F range), brass sensor with sensor guard, stainless steel capillary tube, fully automatic- non electric, long term tested to 5000 cycles (1.3 Degree F).
1. Pressure Ratings:
   a. Maximum WaterTemperature: 250 degrees F.
   b. Maximum Steam Pressure: 15 psig.
   c. Max. Static Pressure: 145 psi
   d. Max. Differential Pressure: 20 psi (Sized for 5 psi pressure drop at design flow)
2. Valve Coefficients (Cv):
   a. 1/2 inch body size: 1.8
   b. 3/4 inch body size: 2.5
   c. 1 inch body size: 2.74
   d. 1-1/4 inch body size: 5.0

B. Acceptable Manufacturer: MACON CONTROLS, 118 Exchange Street, Chicopee, MA, 01013, (413) 594-8695.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install valves at locations noted on the drawings or specified. In addition, comply with the following requirements:

1. Install valves where required for proper operation of piping and equipment including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Non-rising stem valves shall be used only where headroom prevents full extension of rising stems. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

3. Install gate valves for shut-off; to isolate equipment, parts of systems, and vertical risers and any banked system of coils and to separate each coil.

4. Hose gate valves: Provide hose gate valves to drain the pipe at the low points of the system.

5. Install globe for throttling service and control device.

6. Provide 1" gate vent valves at all high points in the piping system.

7. Provide lift check valves at the discharge of all pumps as shown on the Drawings.

8. Outside Screw and Yoke Type: Gate valves in lines leading from the boilers to the boiler steam header, in boiler blow-off lines, and at other points so specified or shown on the drawings shall have outside screw and yoke (OS&Y) with bronze rising stem.

B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Mechanical Actuators: Install mechanical actuators with chain operators where indicated on the drawings and wherever valves are installed more than 8’-0” above the floor (except for valves concealed above ceilings). Extend chains to about 5'-6" above the floor and hook to clips to clear aisle passage or provide chain buckets (Babbitt Bucket or equal).

D. Shutoff valves shall be installed on the supply and return side of all heat exchangers.

E. Shutoff valves shall be installed on the building supply and return of central utility systems and district heating and cooling systems.

F. Shutoff valves shall be installed on both sides of a pressure-reducing valve.

G. Shutoff valves shall be installed on connections to mechanical equipment and appliances.

3.02 MANUAL CONTROL VALVES FOR DIRECT RADIATION

A. Provide manually operated valve for each cast iron radiator, convector or finned type radiator. Do not install manually operated valves on any standing radiation, which is provided with an individual automatic temperature control valve.

B. Hot Water Application:
   1. Install globe, angle or straight-way type radiator valves for all hot water radiation. Where a regular globe or angle type valve cannot be used, install an offset body globe or offset corner pattern valve. Size valve full size of supply run out serving each heating unit.
   2. Install balancing fittings, full size of runouts, on all standing hot water radiation, whether or not provided with an automatic temperature control valve. Install balancing fittings in the returns only, of radiation installed in series.

3.03 DISCHARGE PIPING FROM LIQUID RELIEF VALVES

A. Connection vent piping to the discharge outlet of all relief valves and terminate over floor drain, bell outlet or other approved point of waste.

3.04 VALVE APPLICATION SCHEDULE

A. Schedule of valve applications for the different services is as follows:

   1. Chilled Water (CWS & CWR) 125 psig and less:
      a. 3 inches and Less: Screwed, solder, or press-fit ends, A or D gates or BV balls, J or 0 globe or angles and S or U checks.
      b. 4 inches and Up: Flanged end, C gates or BF butterflies, K globe or angles and V checks.
   2. Condensate Returns (LPR & MPR) 125 psig and less:
      a. 2 inches and Less: Screwed end, A gates, J globe or angles and S checks.
      b. 2-1/2 inches and Up: Flanged end, C gates, K globe or angles and V checks.
   3. Condenser Water (CF & CR) 125 psig and less:
      a. 3 inches and Less: Screwed, solder, or press-fit ends, A or D gates or BV balls, J or 0 globe or angles and S or U checks.
      b. 4 inches and Up: Flanged end, C gates or BF butterflies, K globe or angles and V checks.
   4. Hot Water (HWS & HWR) 125 psig and less:

a. 3 inches and Less: Screwed, solder, or press-fit ends, A or D gates or BV balls, J or 0 globe or angles and S or U checks.
b. 4 inches and Up: Flanged end, C gates or BF butterflies, K globe or angles and S checks.

5. Refrigerants - 700 psig and less, Up to 3 1/8 inches O.D.: Brazed or flared end BVR ball valve.

END OF SECTION

MP:xx

SECTION 230529 - PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings:

1. Details of trapeze hangers and upper hanger attachments for piping 4 inches in diameter and over. Include the number and size of pipe lines to be supported on each type of trapeze hanger.
2. Details of pipe anchors.

B. Product Data: Catalog sheets, specifications and installation instructions for each item specified except fasteners.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Combination clevis hanger, pipe insulation shield and vapor barrier jacketed high density insulating saddle with companion high density filler piece.

1. Insulating saddles and filler pieces shall be of the same thickness and materials as the adjoining pipe insulation. Saddles shall cover the lower 180 degrees of the pipe or tubing, and companion filler pieces shall cover the upper 180 degrees of the pipe or tubing. Physical sizes, gages, etc. of the components of insulated hangers shall be in accordance with the following schedule:

PIPE OR TUBING SIZE (Inches)	SHIELD LENGTH (Inches)	SHIELD GAGE	SADDLE LENGTH (Inches)	VAPOR BARRIER JACKET LENGTH (Inches)
UP to 2-1/2	4	16	6	10
3 to 6	4	14	6	10
8 to 14	10	12	12	16
16 and up	10	10	12	16

B. Pipe Insulation Shields: Fabricated of steel, with a minimum arc of 180 degrees, unless otherwise indicated. Shields for use with hangers and supports, with the exception of combination clevis type hangers, shall be in accordance with the following schedule:

PIPE OR TUBING SIZE (Inches)	SHIELD LENGTH (Inches)	SHIELD GAGE
Up to 2-1/2	8	18
3 to 8	10	16
10 to 14	12	12
16 and up	18	10

C. Pipe covering Protection Saddles: 3/16 inch thick steel, of sufficient depth for the insulation thickness specified, notched so that saddle contact with the pipe is approximately 50 percent of the total axial cross section. Saddles for pipe 12 inches in size and larger shall have a center support.

PIPE SIZE (Inches)	SADDLE LENGTH (Inches)	SADDLE GAGE
8” and up	12”	7 (3/16”)

D. Pipe Hangers: Height adjustable standard duty clevis type, with cross bolt and nut. Pipe spreaders or spacers shall be used on cross bolts of clevis hangers, when supporting piping 10 inches IPS and larger.

1. Swivel ring type hangers will be allowed for sprinkler piping up to a maximum of 2 inches in size.

E. Adjustable Floor Rests and Base Flanges: Steel

F. Hanger Rods: Mild, low carbon steel, fully threaded or threaded at each end, with two nuts at each end for positioning rod and hanger, and locking each in place.

G. Riser Clamps: Malleable iron or steel.

H. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, 2-1/2 to 20 inches, from single rod if horizontal movement caused by expansion and contraction might occur.

I. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, 2 to 30 inches, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction

J. Restraints, Anchors, and Supports for Grooved End Piping Systems: As recommended by the grooved end fitting manufacturer.

K. Foam Insulated Pipe Hanger: Single-piece thermally insulated pipe hanger with self-adhesive closure. CFC-free PET load-bearing segments embedded in closed cell insulation with outer shell of 30-mil thick painted aluminum.

2.02 FASTENERS

A. Sleeve Anchors (Group II, Type 3, Class 3): Molly's Div./USM Corp. Parasleeve Series, Ramset's Dynabolt Series, or Red Head/Phillips AN1405, HN-1614, FS-1411 Series.

B. Wedge Anchors (Zinc Plated, Group II, Type 4, Class 1): Hilti's Kwik Bolt Series, Molly's Div./USM Corp. Parabolt PB Series, Ramset's Trubolt T Series, or Red Head/Phillips WS-3822.

C. Self-Drilling Anchors (Group III, Type 1): Ramset's RD Series, or Red Head/Phillips Series S-14.

D. Non-Drilling Anchors (Group VIII, Type 1): Ramset's Dynaset DS Series, Hilti's HDI Series, or Red Head/Phillips J Series.

E. Stud Anchors (Group VIII, Type 2): Red Head/Phillips JS-38 Series.

F. Continuous Slotted Type Concrete Insert, Galvanized:

1. Load Rating 800 lbs/ft: Kindorf's D-986.
2. Load Rating 1500 lbs/ft: Kindorf's D-980.
3. Load Rating 3000 lbs/ft: Hohmann & Barnard's Inc. Type CS-H.
4. Load Rating 4500 lbs/ft: Hohmann & Barnard's Inc. Type CS-HD.

G. Threaded Type Concrete Insert: Galvanized ferrous castings, internally threaded to receive 3/4 inch dia machine bolts.

H. Wedge Type Concrete Insert: Galvanized box-type ferrous castings, designed to accept 3/4 inch dia bolts having special wedge shaped heads.

I. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; size and type to suit application; galvanized for high humidity locations, and treated wood; plain finish for other interior locations. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work.

2.03 SHOP PAINTING AND PLATING

A. Hangers, supports, rods, inserts and accessories used for pipe supports, unless chromium plated, cadmium plated or galvanized shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper pipe or copper tubing.

B. Hanger supports for chromium plated pipe shall be chromium plated brass.

PART 3 - EXECUTION

3.01 PREPARATORY WORK

A. Place inserts into construction form work expeditiously, so as not to delay the work.

3.02 INSTALLATION

A. Do not hang or support one pipe from another or from ductwork.

B. Support all insulated horizontal piping by means of hangers or supports with insulation shields installed outside of the insulation.

C. Space hangers or supports for horizontal piping on maximum center distances as listed in the following hanger schedules, except as otherwise specified, or noted on the Drawings.

1. For Steel, Alloy Steel, and Fibrous glass Reinforced Plastic Pipe (FRP):

Pipe Size (Inches)	Maximum Spacing (Feet)
1 and under	8
1-1/4 and 1-1/2	9
2	10
2-1/2 and over	12

2. For Copper Pipe and Copper Tubing:

PIPE OR TUBING SIZE (Inches)	MAXIMUM SPACING (Feet)
3/4 and under	5
1-1/4	6
1-1/2 and over	8

3. For Directional Changes: Install a hanger or support close to the point of change of direction of all pipe runs in either a horizontal or vertical plane.
4. For Concentrated Loads: Install additional hangers or supports, spaced as required and directed, at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support the concentrated loads.
5. For Branch Piping Runs and Runouts over 5 Feet in Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.
6. Parallel Piping Runs: Where several pipe lines run parallel in the same plane and in close proximity to each other, trapeze hangers may be submitted for approval. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.

D. Size hanger rods in accordance with the following:

PIPE OR TUBING SIZE (Inches)	SINGLE ROD HANGER SIZE (Inches)		DOUBLE ROD HANGER SIZE (Inches)	
	Pipe	Tubing	Pipe	Tubing
1/2 to 2	3/8	1/4	3/8	1/4
2-1/2 and 3	½	3/8	3/8	1/4
4 and 5	5/8	1/2	1/2	3/8
6	¾	1/2	5/8	1/2
8, 10 and 12	7/8	5/8	3/4	5/8

1. Secure hanger rods as follows: Install one nut under clevis, angle or steel member; one nut on top of clevis, angle or steel member; one nut inside insert or on top of upper hanger attachment and one nut and washer against insert or on lower side of upper hanger attachment. A total of four nuts are required for each rod, two at upper hanger attachment and two at hanger.

E. Vertical Piping:

1. Support vertical risers of piping systems, by means of heavy duty hangers installed close to base of pipe risers, and by riser clamps with extension arms at intermediate floors, with the distance between clamps not to exceed 10 feet on copper pipe and 15 feet on steel pipe, unless otherwise specified. Support pipe risers in vertical shafts equivalent to the aforementioned. Install riser clamps above floor slabs, with the extension arms resting on floor slabs. Provide adequate clearances for risers that are subject to appreciable expansion and contraction, caused by operating temperature ranges.
2. Support extension arms of riser clamps, secured to risers to be insulated for cold service, 4 inches above floor slabs, to allow room for insulating and vapor sealing around riser clamps.

F. Floor Supports: Install adjustable yoke rests with base flanges, for the support of piping, unless otherwise indicated on the Drawings. Install supports in a manner, which will not be detrimental to the building structure.

3.03 UPPER HANGER ATTACHMENTS

A. General:

1. Do not use drive-on beam clamps.
2. Do not support piping over 4 inches in size from steel bar joists. Secure upper hanger attachments to steel bar joists at panel points of joists.
3. Do not drill holes in main structural steel members.
4. "C" clamp type of upper hanger attachments with restraining straps may be used as upper hanger attachments for the support of piping up to a maximum of 3 inches in size and a temperature from 50 degrees F to 200 degrees F.

B. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by pipe support spacing. Select steel members for use as intermediate

supports based on a minimum safety factor of five.

1. Do not use drive-on beam clamps.
2. Do not support piping over 4 inches in size from steel bar joists. Secure upper hanger attachments to steel bar joists at panel points of joists.
3. Do not drill holes in main structural steel members.
4. "C" clamp type of upper hanger attachments with restraining straps may be used as upper hanger attachments for the support of piping up to a maximum of 3 inches in size and a temperature from 50 degrees F to 200 degrees F.

C. Attachment to Concrete Filled Steel Decks (Total thickness, 2-1/2 inches or more): Where necessary, attach hangers to the deck with welding studs (except at roof decks), thru-bolts with fish plates or tee hangers. Do not support a load, in excess of 250 lbs from any single welded stud**.**

D. Attachment to Cast-In-Place Concrete: Secure to overhead construction by means of cast-in-place concrete inserts.

E. Attachment to Existing Cast-In-Place Concrete:

1. For piping up to a maximum of 4 inches in size, secure hangers to overhead construction with self-drilling type expansion shields and machine bolts.
2. Secure hangers to wall or floor construction with single unit expansion shields or self-drilling type expansion shields and machine bolts.

F. Attachment to Cored Precast Concrete Decks (Flexicore, Dox Plank, Spancrete, etc.): Secure attachments to structural steel wherever possible. When fill is applied over decks, thru-bolts and fish plates may be used to support piping up to a maximum of 4 inches in size; mechanically expanded rod hangers or toggle bolts may be installed in cells for the support of piping up to a maximum of 2-1/2 inches in size.

G. Attachment to Hollow Block or Tile Filled Concrete Decks: Secure hangers to structural steel wherever possible. Inserts may also be used by omitting a block and pouring a solid concrete block, with a cast-in-place insert where required.

H. Attachment to Waffle Type Concrete Decks: Provide cast-in-place inserts where required. When fill is applied over deck, thru-bolts and fish plates may be used.

I. Attachment to Precast Concrete Tee Construction:

1. Secure hangers to tees by any of the following methods:
   a. Tee hanger inserts between adjacent flanges.
   b. Thru-bolts and fish plates, except at roof deck without concrete fill.
   c. Dual unit expansion shields in webs of tees. Install shields as high as possible in the webs.
2. Exercise extreme care in the field drilling of holes to avoid damage to reinforcing.
3. Do not use powder driven fasteners.

J. Attachment to Wood Construction: Secure hangers to the sides (only) of wood members, by means of malleable iron side beam connectors, or malleable iron or steel side beam brackets. Do not secure hanger attachments to nailing strips resting on top of steel

beams.

1. Secure side beam connectors to wood members with two No. 18 x 1-1/2 inch long wood screws, or two No. 16 x 1-1/2 inch long drive screws. Do not support piping over 1-1/2 inches in size from side beam connectors. Do not hammer in wood screws.
2. Secure side beam brackets to wood members with steel bolts or lag screws. Do not use lag screws in wooden members having a nominal thickness (beam face) under 2 inches in size. Install bolts or lag screws, in the sides of a timber or a joist, at the mid-point or above, not less than 2-1/2 inches from the lower edge when supporting branch lines and not less than 3 inches from the lower edge when supporting mains. Install heavy gage steel washers under all nuts.
3. Secure side beam brackets to wooden beams or joists, with lag screws or bolts of size as follows:

PIPE SIZE (Inches)	LAG SCREW SIZE (Inches)	BOLT DIAMETER (Inches)
2 and under	3/8 diam x 1-3/4	3/8
2-1/2 and 3	1/2 diam x 2	1/2
4 and 5"	Use bolt	5/8

   a. Do not support piping larger than 3 inches with lag screws. Pre-drill holes for lag screws 1/8 inch in diameter less than the root diameter of the lag screw thread.
   b. The minimum width of the lower face of wood beams or joints in which lag screws of size as specified may be used is as follows:

LAG SCREW DIAMETER (Inches)	NOMINAL WIDTH OF BEAM FACE (Inches)
3/8	2
1/2	3

4. Do not secure hanger attachment to the diagonals or vertical members of the trusses.

3.04 ANCHORS, RESTRAINTS, RIGID SUPPORTS, STAYS AND SWAY BRACES

A. Install pipe anchors, restraints and sway braces, at locations noted on the Drawings. Design anchors so as to permit piping to expand and contract freely in opposite directions, away from anchor points. Install anchors independent of all hangers and supports, and in a manner which will not affect the structural integrity of the building.

3.05 COMBINATION CLEVIS HANGER, PIPE INSULATION SHIELD AND VAPOR BARRIER JACKETED HIGH DENSITY INSULATING SADDLES

A. Install a combination clevis hanger, pipe insulation shield and vapor barrier jacketed high

density insulating saddles, at all points of support for piping or tubing to be insulated for cold and hot service insulated piping. Direct hanger contact of pipe for hot or cold piping is not allowed. Furnish companion high density vapor barrier jacketed saddle pieces, of the same material, thickness and length, for installation over the top 180 degree surface of pipe or tubing, at each point of support where an insulated clevis hanger is utilized.

3.06 PIPE SUPPORT FOR SYSTEMS INSULATED WITH FLEXIBLE ELASTOMERIC FOAM

A. Install a single-piece thermally insulated pipe hanger with self-adhesive closure at all points of support for piping or tubing to be insulated for cold and hot service insulated piping. Direct hanger or clamp contact of pipe for hot or cold piping is not allowed.

3.07 PIPE INSULATION SHIELDS

A. Install a pipe insulation shield (unless provided with a combination clevis hanger as described above) at all points of support, for cold and hot service insulated piping. Direct hanger contact of pipe for hot or cold piping is not allowed. Center shields on all hangers and supports, and install in such a manner so as not to cut, puncture or compress insulation.

3.08 PIPE COVERING PROTECTION SADDLES

A. Install pipe covering protection saddles at all points of support, for steel piping 6 inches in size and larger, insulated with hot service insulation. Weld saddles to piping to insure movement with pipe.

END OF SECTION 230529

SECTION 230550 - VIBRATION ISOLATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the drawings and as specified herein to provide complete vibration isolation systems in proper working order.

1.02 SUBMITTALS

A. Refer to related sections elsewhere for procedural instructions for submittals.

B. Before ordering any products, submit shop drawings of the items listed below. The shop drawings must be complete when submitted and must be presented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection of the submittal.

1. A complete description of products to be supplied, including product data, dimensions, specifications, and installation instructions.
2. Detailed selection data for each vibration isolator supporting equipment, including:
   a. The equipment identification mark;
   b. The isolator type;
   c. The actual load;
   d. The static deflection expected under the actual load;
   e. The specified minimum static deflection.
3. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.
4. Special details necessary to convey complete understanding of the work to be performed.

1.03 MATERIAL AND EQUIPMENT

A. All vibration isolation mounts shall be supplied by one of the following acceptable manufacturers:

Amber/Booth Co. (Houston, TX.....A.B.
AVNEC Incorporated (Floral Park, NY).....CA.I.
Mason Industries Inc. (Hauppaughe, NY).....M.I.
Kinetics Noise Control Inc. (Dublin, OH). .....K.N.C.
Vibration Mountings & Controls Inc. (Butler, NJ) .....V.M.C.

B. Unless otherwise specified, supply only new equipment, parts and materials.

C. Substitutions of equal equipment beyond the alternatives listed will be permitted only with the written permission of the Engineer. Accompany each request for acceptance of substitute equipment with manufacturer's certified data proving the equivalence of the proposed substitute in quality and performance. The Engineer shall be the final judge of

the validity of the data submitted.

1.04 REQUESTS FOR CHANGE

A. Any requests for changes to the specifications must be submitted in writing at least ten days prior to bid closing. Approval will be given through a written addendum.

1.05 QUALITY ASSURANCE

A. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.

B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.

C. Supply and install any incidental materials such as mounting brackets, attachments and other accessories as may be needed to meet the requirements stated herein, even if not expressly specified or shown on the drawings, without claim for additional payment.

D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.

E. Should any rotating equipment cause excessive noise or vibration when properly installed on the specified isolators, the Contractor shall be responsible for rebalancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

F. Upon completion of the work, Engineer shall inspect installation and shall inform installing contractor of any further work that must be completed. Make all adjustments as directed by Architect that result from the final inspection. Work shall be done before vibration isolation systems are accepted.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATOR TYPES

A. General

1. All springs installed out-of-doors shall be cadmium-plated, zinc electroplated or powder-coated after fabrication. Hardware and other metal parts shall be cadmium-plated or galvanized. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.
2. All isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.
3. Isolator types are scheduled to establish minimum standards. At the Contractor's option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories and seismic restraint features must not

degrade the isolation performance of the isolators.

4. Static deflection of isolators shall be as provided in the EXECUTION section and as shown on the drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

B. Type FSN (Floor Spring and Neoprene)

1. Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Springs shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1 (one). All mounts shall have leveling bolts.
2. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is used, GROMMETS shall be provided for each bolt hole in the base plate.
3. If the basic spring isolator has a neoprene friction pad on its base and an NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NP isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, bearing plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.
4. Type FSN isolators shall be one of the following products with the appropriate neoprene pad (if used) selected from Type NP or acceptable equal:

Type SW .....A.B.
Type FSS .....A.I.
Type SLF .....M.I.
Type FDSK. .....N.C.
Series A .....V.M.&C.

C. Type FSNTL (Floor Spring and Neoprene Travel Limited)

1. Spring isolators shall be freestanding and laterally stable without any housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Spring shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately 1 (one). All mounts shall have leveling bolts. All mounts shall have vertical travel limit stops to control extension when weight is removed. The travel limit stops shall be capable of serving as blocking during erection of the equipment. A minimum clearance of 1/4" shall be maintained around restraining bolts and between the limit stops and the spring to avoid interference with the spring action.
2. The spring element in the isolator shall be set in a neoprene cup and have a steel washer or a flat surface in contact with the neoprene to distribute the load evenly over the bearing surface of the neoprene. Alternatively, each isolator shall be

mounted on a Type NP isolator. If the NP isolator is used, a rectangular bearing plate of appropriate size shall be provided to load the pad uniformly within the manufacturer's recommended range. If the isolator is to be fastened to the building and the NP isolator is used, GROMMETS shall be provided for each bolt hole in the base plate.

3. If the basic spring isolator has a neoprene friction pad on its base and an NP isolator is to be added to the base, a galvanized steel, stainless steel or aluminum bearing plate shall be used between the friction pad and the NP isolator. If the isolator is outdoors, bearing plates shall not be made of galvanized steel. The NP isolator, bearing plate and friction pad shall be permanently adhered to one another and to the bottom of the isolator base plate.
4. Type FSNTL isolators shall be one of the following products, with the appropriate neoprene pad (if used) selected from Type NP or acceptable equal:

Type CT .....A.B.
Type RS.....A.I.
Type SLR.....M.I.
Type FLS.....K.N.C.
Series AWR.....V.M.&C.

D. Type FN (Floor Neoprene)

1. Neoprene isolators shall be neoprene-in-shear type with steel reinforced top and base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be provided in the base and the top shall have a threaded fastener. The mounts shall include leveling bolts that may be rigidly connected to the equipment.
2. Type FN isolators shall be one of the following products or acceptable equal:

Type RVD.....A.B.
Type NCM.....A.I.
Type ND .....M.I.
Type RD.....K.N.C.
Series RD.....V.M.&C.

E. Type PCF (Precompressed Fiberglass)

1. Precompressed fiberglass blocks shall be made of molded inorganic glass fiber that is individually coated and sealed with an impervious elastomeric membrane. Fiberglass shall be severely overloaded during manufacture to stabilize the material into a product that is permanent and has consistent, predictable dynamic properties.
2. Type PCF isolators shall be one of the following products or acceptable equal.

Type KIP .....K.N.C.

F. Type NP (Neoprene Pad)

1. Neoprene pad isolators shall be one layer of 1/4" to 3/8" thick ribbed or waffled neoprene. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.
2. Type NP isolators shall be one of the following products or acceptable equal:

Type NR.....A.B.
Type NP.....A.I.
Type W .....M.I.
Type NPS .....K.N.C.
Series Shear Flex.....V.M.&C.

G. Type DNP (Double Neoprene Pad)

1. Neoprene pad isolators shall be formed by two layers of 1/4" to 3/8" thick ribbed or waffled neoprene, separated by a galvanized steel, stainless steel or aluminum plate. If the isolator is outdoors, the plate shall not be made of galvanized steel. These layers shall be permanently adhered together. The pads shall be sized so that they will be loaded within the manufacturer's recommended range.
2. Type DNP isolators shall be formed from one of the following products or acceptable equal:

Type NR.....A.B.
Type DNP.....A.I.
Type WSW .....M.I.
Type NPS .....K.N.C.
Series Shear Flex.....V.M.&C.

H. Type HSN (Hanger Spring and Neoprene)

1. Vibration isolation hangers shall consist of a free standing and laterally stable steel spring and a neoprene element in series, contained within a steel housing. Spring diameters and hanger housing lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc before contacting the housing. Alternatively, other provisions shall be made to allow for a 30° arc of movement of the bottom hanger rod without contacting the isolator housing. Spring diameter shall be not less than 0.8 of the compressed height of the spring at the rated load. Spring elements shall have a minimum additional travel-to-solid equal to 50% of the rated deflection. The neoprene element shall be designed to have a 0.3" minimum static deflection. The deflection of both the spring element and the neoprene element shall be included in determining the overall deflection of Type HSN isolators.
2. Type HSN isolators shall be one of the following products or acceptable equal:

Type BSRA.....A.B.
Type SANSH.....A.I.
Type 30N .....M.I.
Type SRH or SFH.....K.N.C.
Type RSH or RFH.....V.M.&C.

I. Type HN (Hanger Neoprene)

1. Vibration isolation hangers shall consist of a neoprene-in-shear element contained within a steel housing. A neoprene neck bushing shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. The diameter of the hole in the housing shall be sufficient to permit the hanger rod to swing through a 30° arc before contacting

the hanger housing.

2. Type HN isolators shall be one of the following products or acceptable equal:

Type BRD-A .....A.B.
Type SANH .....A.I.
Type HD .....M.I.
Type RH or FH .....K.N.C.
Type RHD or RFD .....V.M.&.C.

J. Type RI (Roof Isolator)

1. Roof isolators shall meet all of the requirements of the type FSNTL isolator, and shall be provided with waterproof spring covers that allow for the adjustment or removal of the springs. The isolators shall be provided with a structural top plate for the welding or bolting of supplementary support steel. The isolators shall accept 2 inch thick roofing insulation and be capable of being flashed directly into the roof membrane. Each isolator shall be provided complete with a wood nailer and flashing.
2. Type RI isolators shall be one of the following products or acceptable equal:

Type FRS.....A.I.

2.02 EQUIPMENT BASES

A. Type BSR (Base - Steel Rail)

1. Steel rail bases shall consist of structural steel sections sized to provide a rigid beam that will not twist, deform, or deflect in any manner that will negatively affect the operation of the supported equipment or the vibration isolation mounts. Rail bases shall include side mounting brackets for attachment of vibration isolators.
2. Type BSR bases will be supplied by the isolator manufacturer and shall be one of the following products or acceptable equal:

Type C or CIS .....A.B.
Type SR.....A.I.
Type R or ICS.....M.I.
Type KRB or KFB .....K.N.C.
Type WFR or AR .....V.M.&C.

B. Type BSF (Base - Steel Frame)

1. Steel base frames shall consist of structural steel sections sized, spaced, and connected to form a rigid base which will not twist, rack, deform, or deflect in any manner which will negatively affect the operation of the supported equipment or the vibration isolation mounts. Frames shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. The depth of steel frame bases shall be at least 1/10 the longest dimension of the base and not less than 6". The base footprint shall be large enough to provide stability for supported equipment.

2. Frame bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.
3. Type BSF bases shall be supplied by the isolator manufacturer and shall be one of the following products or acceptable equal:

Type WX.....A.B.
Type SB.....A.I.
Type WFSL .....M.I.
Type SFB or SRB .....K.N.C.
Series WFB .....V.M.&C.

C. Type BIB (Base - Inertia Base)

1. Concrete inertia bases shall be formed of stone-aggregate concrete (150 lb./cu.ft.) and appropriate steel reinforcing cast between welded or bolted perimeter structural steel channels. Inertia bases shall be built to form a rigid base that will not twist, rack, deform, deflect, or crack in any manner that would negatively affect the operation of the supported equipment or the vibration isolation mounts. Inertia bases shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. Inertia base depth shall be at least 1/12 the longest dimension of the inertia base and not less than 6". The base footprint shall be large enough to provide stability for supported equipment. Inertia bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.
2. The steel frame and reinforcement shall be supplied by the vibration isolator manufacturer. Concrete may be provided by the General Contractor.
3. Frame and reinforcement for Type BIB bases shall be one of the following products or acceptable equal:

Type CPF .....A.B.
Type CB .....A.I.
Type KSL .....M.I.
Type CIB-L or CIB-H.....K.N.C.
Series WPF.....V.M.&C.

D. Type RC-1 (Roof Curb, Type 1)

1. Type RC-1 isolation bases shall be a prefabricated assembly consisting of an extruded aluminum frame and steel spring isolation system that fits over the roof curb and under the isolated equipment. The aluminum frame shall be sufficiently rigid to support the equipment load without detrimental twist or deflection. Spring isolators shall be selected and positioned along the curb to achieve the minimum static deflection called for in the schedule. The static deflection shall be constant around the entire periphery of the base. Springs shall be free standing, laterally stable with a diameter of not less than 0.8 times the compressed height, and have additional travel-to-solid that is at least 50% of the rated deflection. Resilient neoprene snubbers shall be provided at the corners of the base to limit the movement of the equipment under wind load to 1/4".

2. The isolation curb base shall be made weather tight by sealing all around the periphery with closed cell neoprene or flexible membrane that shall in no way inhibit the vibration isolation of the spring elements. A closed cell sponge gasket or field caulking shall be used between the equipment unit and the isolation curb base and between the isolation curb and roof curb to form a weather-tight seal. Each spring isolator used in the curbs shall be weather-protected as described in the PRODUCTS section under General.
3. Type RC-1 vibration isolation curb bases shall be supplied by the isolator manufacturer and shall be one of the following products or acceptable equal:

RTIR ..... A.B.
Type CMAB .....M.I.
Type ASR.....K.N.C.
Series ATR .....V.M.&C.

E. Type RC-2 (Roof Curb, Type 2)

1. Type RC-2 isolation bases shall be a prefabricated assembly consisting of a structural steel frame and steel spring isolation system that forms the roof curb under the isolated equipment. The steel frame shall be sufficiently rigid to support the equipment load without detrimental twist or deflection. Spring isolators shall be selected and positioned along the curb to achieve the minimum static deflection called for in the schedule. The static deflection shall be constant around the entire periphery of the base. Springs shall be free standing, laterally stable with a diameter of not less than 0.8 times the compressed height, and have additional travel-to-solid that is at least 50% of the rated deflection. Spring elements shall include travel limit stops that are capable of serving as blocking during erection of the equipment. A minimum clearance of 1/4" shall be maintained around restraining bolts as they pass through the limit stop brackets. Springs and limits stops shall be adjusted to limit movement of the equipment under wind load to 1/4".
2. The isolation curb base shall be made weather tight by sealing all around the periphery with closed cell neoprene, flexible membrane or light gauge spring metal loop, which shall in no way inhibit the vibration isolation of the spring elements. A closed cell sponge gasket or field caulking shall be used between the equipment unit and the isolation curb base and between the isolation curb and roof curb to form a weather-tight seal. Each spring isolator used in the curbs shall be weather-protected as described in the PRODUCTS section under General.
3. Type RC-2 vibration isolation curb bases shall be supplied by the isolator manufacturer and shall be one of the following products or acceptable equal:

Type P .....A.I.
Type RSC .....M.I.
Type SSR .....K.N.C.
Vibrocurb .....ThyCurb

F. RR (Roof Rail)

1. Roof rail bases shall consist of continuous structural support rails that combine equipment support and vibration isolation into one unitized assembly. The rails shall incorporate springs that are free standing, laterally stable with a diameter of

not less than 0.8 times the compressed height, and have additional travel-to-solid that is at least 50% of the rated deflection. Spring elements shall include travel limit stops that are capable of serving as blocking during erection of the equipment. A minimum clearance of 1/4" shall be maintained around restraining bolts as they pass through the limit stop brackets. Springs and limits stops shall be adjusted to limit movement of the equipment under wind load to 1/4". The entire roof rail assembly shall be an integral part of the roof's membrane waterproofing and shall be dry galvanized or plastic-coated.

2. Type RR roof rail bases shall be one of the following products or acceptable equal:

Type R .....A.I.

2.03 RESILIENT PENETRATION SLEEVE/SEAL

A. Resilient penetration sleeve/seals shall be field-fabricated from a pipe or sheet metal section that is l/2" to 3/4" larger than the penetrating element in all directions around the element, and shall be used to provide a sleeve through the construction penetrated. The sleeve shall extend 1" beyond the penetrated construction on each side. The space between the sleeve and the penetrating element shall be packed with glass fiber or mineral wool to within 1/4" of the ends of the sleeve. The remaining 1/4" space on each end shall be filled with acoustical sealant to form an airtight seal. The penetrating element shall be able to pass through the sleeve without contacting the sleeve. Alternatively, prefabricated sleeves accomplishing the same result are acceptable.

2.04 RESILIENT LATERAL SUPPORTS

A. These units shall either be a standard product of the vibration isolation mounting manufacturer, or be custom fabricated from standard components. These units shall incorporate neoprene isolation elements similar to Type FN that are specifically designed to provide resilient lateral bracing of ducts or pipes.

B. Resilient lateral supports shall be one of the following products or acceptable equal:

Type Custom .....A.B.
Type RPTG .....A.I.
Type ADA .....M.I.
Type RGN .....K.N.C.
Type MDPA .....V.M.&C.

2.05 THRUST RESTRAINTS

A. Thrust restraints shall consist of a spring element in series with a neoprene pad. The unit shall be designed to have the same deflection due to thrust-generated loads as specified for the isolators supporting the equipment. The spring element shall be contained within a steel frame and be designed so it can be pre-compressed at the factory to allow for a maximum of 1/4" movement during starting or stopping of the equipment. Allowable movement shall be field-adjustable. The assembly shall be furnished complete with rods and angle brackets for attachment to both the equipment and the adjacent fixed structural anchor. The thrust restraints shall be installed on the discharge of the fan so that the restraint rods are in tension. Assemblies that place the rods in compression are not acceptable. The holes in the spring restraint brackets through which the restraint rods pass must be oversized to prevent contact between the brackets and rods.

B. Thrust restraints shall be one of the following products or an acceptable equal:

Type TRK .....A.B.
Type TR.....A.I.
Type WB.....M.I.
Type HSR.....K.N.C.

2.06 GROMMETS

A. Grommets shall be specially formed to prevent bolts from directly contacting the isolator base plate, and shall be sized so that they will be loaded within the manufacturer's recommended load range.

B. Grommets shall either be custom made by combining a neoprene washer and sleeve, or be one of the following products or an acceptable equal:

Type Isogrommets .....MBIS, Inc. (Bedford Heights, OH)
Type WB .....Barry Controls (Brighton, MA)
Type HG.....Mason Industries, Inc. (Hauppauge, NY)

2.07 ACOUSTICAL SEALANT

A. Sealants for acoustical purposes as described in this specification shall be silicone or one of the non-setting sealants indicated below:

Acoustical sealant.....D.A.P.
BR-96 .....Pecora
Acoustical sealant.....Tremco
Acoustical sealant.....U.S.G.

PART 3 - EXECUTION

3.01 APPLICATION

A. General

1. Refer to the PRODUCTS section of this specification for vibration isolation devices identified on the drawings or specified herein.
2. The static deflection of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

B. Major Equipment

1. Unless otherwise shown or specified, all floor-mounted major equipment shall be set on 4" high concrete housekeeping pads.
2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as scheduled on the drawings or specified hereunder.
3. Thrust restraints shall be installed on all suspended fans and on all floor-mounted fans developing 4" or more of static pressure, unless the horizontal component of

the thrust force can be demonstrated to be less than 10% of the equipment weight.

C. Miscellaneous Mechanical Equipment: Miscellaneous pieces of mechanical equipment such as expansion tanks which are connected to isolated piping systems shall be vibration-isolated from the building structure by Type NP or Type HN isolators (selected for 0.1" static deflection) unless their position in the piping system requires a higher degree of isolation as called for under Pipe Isolation.

D. Pipes

1. All hot water, drain and engine exhaust piping that is connected to vibration-isolated equipment shall be isolated from the building structure within the following limits:
   a. Within 100' total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, etc.)
2. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.
3. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2", Type FSN or HSN isolators shall be used. When the required static deflection is less than or equal to 1/2", Type FN or HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or HN achieving at least 1/4" static deflection.
4. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.
5. Pipes within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.
6. Provide flexible pipe connections as called for under Major Equipment above and wherever shown on the drawings.

E. Ductwork

1. All sheet metal ducts and air plenums that are within mechanical rooms or within a distance of 50' total duct length of connected vibration-isolated equipment (whichever is longer) shall be isolated from the building structure by Type FN, PCF or HN isolators. All isolators shall achieve 0.1" minimum static deflection.
2. Ducts within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

3.02 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.
2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

B. Isolators

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.
2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.
3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.
4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.
5. Hanger rods for vibration-isolated support shall be connected to structural beams or joists, not floor slab between beams and joists. Provide suitable intermediate support members as necessary.
6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.
7. Parallel running pipes may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and unisolated pipes on the same trapeze.
8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.
9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.
10. The installed and operating heights of equipment vibration-isolated with Type FSNTL or Type RI isolators or with Type RC-2 or Type RR isolation bases shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4" clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.
11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.
12. Type RI isolators shall be installed in strict accordance with the manufacturer’s instructions.

C. Bases

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is acceptable to the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
2. Unless otherwise indicated, there is to be a minimum operating clearance of 1" between steel rails, steel frame bases or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

3. Type RC-2 and Type RR isolation bases shall be installed in strict accordance with the manufacturer's instructions.

D. Thrust Restraints: Thrust restraints shall be attached on each side of the fan at the vertical centerline of thrust. The two rods of the thrust restraint shall be parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

E. Grommets: Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

F. Resilient Penetration Sleeve/Seals: Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

END OF SECTION 230550

SECTION 230553 - PIPE AND VALVE IDENTIFICATION

PART 1 - GENERAL

1.01 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions for each item specified.

1.02 REFERENCES

ANSI A13.1 - Scheme for Identification of Piping Systems

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

W.H. Brady Co., Milwaukee, WI.
Emed Co., Buffalo, NY.
Panduit Corp., Tinley Park, IL.
Seton Nameplate Corp., New Haven, CT.
Bunting Inc., Pittsburgh, PA.

2.02 PIPE MARKERS AND ACCESSORIES

A. Snap-on Marker: One piece wrap around type constructed of precoiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, 3/4 inch adhesive strip on inside edge, and 360 degree visibility.

B. Strap-On Marker: Strip type constructed of precoiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, factory applied grommets, and pair of stainless steel spring fasteners.

C. Stick-On Marker: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, and integral flow arrows for applications where flow arrow banding tape is not being used.

D. Pipe Marker Legend and Color Field Sizes:

OD of Pipe or Insulation (Inches)	Letter Size (Inches)	Length of Color Field (Inches)
3/4 to 1-1/4 incl.	1/2	8
1-1/2 to 2 incl.	3/4	8
2-1/2 to 6 incl.	1-1/4	12
8 to 10 incl.	2-1/2	24
Over 10	3-1/2	32

E. Banding Tapes: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating.

1. Plain Tape: Unprinted type; color to match pipe marker background.
2. Flow Arrow Tape: Printed type with integral flow arrows; color to match pipe marker background.

F. Pipe Size Labels: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, vertical reading pipe size in inches, and legend size matching adjacent pipe marker.

2.03 PIPE SERVICE IDENTIFICATION TAGS

A. Type: No. 19 B & S gage brass, with 1/4 inch high pipe service abbreviated legend on one line, over 1/2 inch high pipe size legend in inches, both deep stamped and black filled; and 3/16 inch top hole for fastener.

B. Size: 2 inch square tag.

C. Fasteners: Brass "S" hook or brass jack chain of size as required for pipe to which tag is attached.

2.04 VALVE SERVICE IDENTIFICATION TAGS

A. Type: No. 19 B & S gage brass, with 1/4 inch high valve service abbreviated lettering on one line over 1/2 inch high valve service chart number, both deep stamped and black filled; and with 3/16 inch top hole for fastener.

B. Sizes: HVAC Use: 1-1/2 inch dia round.

C. Fasteners: Brass “S” hook or brass jack chain of size as required for valve stem or handle to which tag is attached.

2.05 VALVE SERVICE IDENTIFICATION CHART FRAMES

A. Type: Satin finished extruded aluminum frame with rigid clear plastic glazing, size to fit 8-1/2 x 11 inches valve chart.

PART 3 - EXECUTION

3.01 PREPARATION

A. Complete testing, insulation and finish painting Work prior to completing the Work of this Section.

B. Clean pipe surfaces with cleaning solvents prior to installing piping identification.

3.02 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturers printed installation instructions, unless otherwise specified.

B. Stick-On Pipe Markers:

1. Install minimum of 2 markers at each specified location, 90 degrees apart on visible side of pipe.
2. Encircle ends of pipe markers around pipe or insulation with banding tape with one inch lap. Use plain banding tape on markers with integral flow arrows, and flow arrow banding tape on markers without integral flow arrows.

C. Pipe Size Labels: Install labels adjacent to each pipe marker and upstream from flow arrow. Install a minimum of 2 pipe size labels at each specified locations, 90 degrees apart on visible side of pipe.

D. Pipe Service Identifications Tags: Attach tags to piping being identified with "S" hooks or jack chains.

3.03 PIPING IDENTIFICATION SCHEDULE

A. Piping Identification Types:

1. Piping or Insulation under 3/4 inch od: Pipe identification tags.
2. Piping or Insulation 3/4 inch to 5-7/8 inch od: Snap-on marker or stick-on marker.
3. Piping or Insulation 6 inch od and Larger: Strap-on marker or stick-on marker.

B. Identify all piping systems, installed within and exterior of the building, piping exposed to view, above all ceilings, bare and insulated, as to content, size of pipe and direction of flow, with the following exceptions:

1. Piping in furred wall spaces, except in valve access panels where valves and piping shall be identified as specified for exposed piping systems.
2. Piping exposed in finished spaces such as offices, classrooms, wards, toilet rooms, shower rooms and spaces as specified.

C. Locate piping identification (with in 24") at valve locations; at points where piping enters and leaves a partition, wall, floor or ceiling, and at intervals of 20 feet on straight runs. Where two or more pipes run in a parallel, place the printed legend and other markers in the same relative location.

3.04 VALVE IDENTIFICATION SCHEDULE

A. Valve Service Identification Tags:

1. Tag service, balance, isolation and control valves installed under this project, with a brass tag fastened to the valve handle or stem, marked to indicate service and numbered in sequence for the following applications:
   a. Valves in heating, ventilating, air conditioning and refrigeration systems.

B. Valve Service Identification Charts:

1. Provide 2 framed valve charts for each piping system specified to be provided with valve identification tags. Type charts on 8-1/2 x 11 inches heavy white bond paper, indicating valve number, service and location.
2. Hang framed charts at locations as directed.

END OF SECTION 230553

SECTION 230554 - DUCT AND EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.01 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions for each item specified

1.02 DELIVERY, STORAGE AND HANDLING

A. Deliver paint to the Site in original, new unopened containers, bearing manufacturers' printed labels.

B. Store materials at the site where directed. Keep storage space clean and accessible to the Engineer at all times.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Paint: Semi-gloss enamel (latex base) complying with the requirements of FS TT-P-001511.

PART 3 - EXECUTION

3.01 PREPARATION

A. Do not execute the Work of this Section until all testing, insulation and finish painting Work have been completed.

B. Place drop cloths or other suitable protection as required to avoid damage and paint spatters on adjacent surfaces.

3.02 DUCT IDENTIFICATION

A. Identify exposed ductwork, bare or insulated, directly connected to air handling apparatus, in the following spaces or rooms, by means of painted stenciled legends:

1. Mechanical Equipment Room
2. Steam Service
3. Refrigeration Machine
4. Boiler Room
5. Penthouse.
6. Power House

B. Locate stenciled legends to be readily visible from any point of observation. Stencil identification along center line of duct, close to equipment. Where view is unobstructed from two directions, apply two sets of stenciling (both sides), visible from each direction.

C. Letter Size: 1-1/2 inches in height.

D. Samples of Ductwork Identification:

1. Outside Air (OA)
2. Supply Air (SA)
3. Return Air (RA)
4. Exhaust Air (EA)

E. Colors: Paint stenciled letters black. Where the background color is dark, paint background white before stenciling.

3.03 EQUIPMENT IDENTIFICATION

A. Identify mechanical equipment, bare or insulated, installed in the following spaces or rooms, by means of painted stenciled legends:

1. Mechanical Equipment Room
2. Steam Service
3. Refrigeration Machine
4. Boiler Room
5. Penthouse
6. Power House
7. Roof – Provide engraved aluminum nameplate
8. At Grade – Provide engraved aluminum nameplate

B. Paint stenciled legends black, a minimum of 1-1/2 inches (6 inches in Mechanical Equipment Rooms) in height, located to be readily visible from a reasonable point of view. Place identification along center line of equipment, if possible.

C. Engraved Plastic-Laminate Signs (Interior use where paint stencil is not appropriate.):

1. ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white (letter color) melamine subcore, except when other colors are indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
2. Engraved with engraver's standard letter style, of sizes and with terms to match equipment identification.
3. Thickness: 1/16 inch, for units up to 20 square inches or 8 inches length; 1/8 inch for larger units
4. Fasteners: Self-tapping stainless steel screws or aluminum pop rivet

D. Engraved Aluminum Nameplate:

1. Black surface, with white (letter color). Fabricate in sizes required for message. Provide two side holes for mechanical fastening.
2. Engraved with engraver's standard letter style, of sizes and with terms to match equipment identification.
3. Thickness: 0.020 inch.
4. Fasteners: Self-tapping stainless steel screws or aluminum pop rivet

E. Samples of Equipment Identification:

1. Air Conditioning Unit AC-1
2. Supply Fan S-1
3. Exhaust Fan E-1
4. Return Fan R-1

3.04 ACCESS DOOR IDENTIFICATION

A. Access doors adjacent to fire damper, smoke damper or smoke detector shall be identified with letters no less than 1/2" high in accordance with NYS IMC.

3.05 APPLICATION OF PAINT

A. Stencil Painting: Apply with a brush or aerosol type spray can.

3.06 CLEANING

A. Clean adjacent surfaces of paint spatters resulting from the Work of this Section.

END OF SECTION 230554

SECTION 230593 - CLEANING AND TESTING

PART 1 GENERAL

1.01 SUBMITTALS

A. Quality Control Submittals

1. Test Reports (Field Tests):
   a. Refrigeration Systems: Submit results of Refrigeration Systems Pressure - Dehydration Tests.
   b. Low Pressure Steam or Hot Water Heating Boilers: Submit results on Boiler Test.
   c. Propylene Glycol System Test: Submit results on Propylene Glycol Systems.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Perform factory testing of factory fabricated equipment in complete accordance with the agencies having jurisdiction.
2. Perform field testing of piping systems in complete accordance with the local utilities and other agencies having jurisdiction and as specified.

1.03 PROJECT CONDITIONS

A. Protection: During test Work, protect controls, gages and accessories which are not designed to withstand test pressures. Do not utilize permanently installed gages for field testing of systems.

1.04 SEQUENCING AND SCHEDULING

A. Transmit written notification of proposed date and time of operational tests to the Owner at least 5 days in advance of such tests.

B. Perform cleaning and testing Work in the presence of the Owner.

C. Pressure test piping systems inside buildings, at the roughing-in stage of installation, before piping is enclosed by construction Work, and at other times as directed. Perform test operations in sections as required and directed, to progress the Work in a satisfactory manner and not delay the general construction of the building. Valve or cap-off sections of piping to be tested, utilizing valves required to be installed in the permanent piping

systems, or temporary valves or caps as required to perform the Work.

D. Duct Systems: Clean new and existing duct system(s) before testing, adjusting, and balancing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Test Equipment and Instruments: Type and kind as required for the particular system under test.

B. Test Media (air, gas, refrigerant, vacuum, water): As specified for the particular piping or system under test.

C. Cleaning Agent (chemical solution, steam, water): As specified for the particular piping, apparatus or system being cleaned.

D. Propylene Glycol: Permanent type inhibited anti-freeze solution as manufactured by Dow Chemical Co. or Union Carbide. Dowfrost or Ucar Protherm respectively. Final system concentration to be as noted on the drawings.

PART 3 EXECUTION

3.01 PRELIMINARY WORK

A. Thoroughly clean pipe and tubing prior to installation. During installation, prevent foreign matter from entering systems. Prevent if possible and remove stoppages or obstructions from piping and systems.

B. Connections or extension of existing piped systems: Prior to connecting to any existing system(s), the Mechanical Contractor shall take sample of fluid and provide test reports of the existing fluids chemical, residuals and or glycol concentration to the Engineer for acceptance. If the test results have not been provided prior to connection, the Mechanical Contractor shall be held responsible in bringing the entire hydronic system within acceptable specifications. The Mechanical Contractor shall top off the new or existing glycol feed tank, at project closeout.

C. Thoroughly clean compressed air, control air, refrigerant pipe and similar systems prior to pressure or vacuum testing.

3.02 PRESSURE TESTS - PIPING

A. Piping shall be tight under test and shall not show loss in pressure or visible leaks, during test operations or after the minimum duration of time as specified. Remove piping which is not tight under test; remake joints and repeat test until no leaks occur.

B. Water Systems:

1. Circulating water systems, including propylene glycol solution systems and cold water make-up piping connections to heating, ventilating, air conditioning and

refrigeration systems, unless otherwise specified:

a. Before final connections are made perform hydrostatic test at 1-1/2 times the maximum working pressure, but not less than 125 psig, for 4 hours.

b. After final connections are made perform hydrostatic retest at a pressure equal to maximum operating system design pressure, but not less than 30 psig, for 4 hours.

2. High temperature water systems (supply and return):

a. Before final connections are made perform hydrostatic test at 450 psig for 4 hours.

b. After final connections are made perform hydrostatic retest at a pressure equal to maximum operating design pressure, but not less than 250 psig for 4 hours.

C. Gas Piping: Before backfilling or concealment perform air test of duration and pressure as required by the local gas company. However, for gas piping designed for pressures of from 4 inches to 6 inches water column, air test at 15 inches Hg for one hour, without drop in pressure. Test gas piping with air only. Check joints for leaks with soap suds.

D. Air Piping:

1. Compressed Air: Test with air at 150 psig for one hour.
2. Control Air: Test with air at 50 psig for one hour.
3. Check joints for leaks with soap suds.

E. Vacuum Piping: Perform air test at 150 psig for one hour, followed by a vacuum test of 25 inches Hg for one hour, during which time the mercury shall remain stationary for the last 30 minutes of test.

3.03 HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS - CLEANING AND OPERATIONAL TESTING

A. Circulating Water Systems:

1. Cleaning: Flush systems and apparatus, upon completion of pressure and miscellaneous tests. Completely open valves and flush each system with clean water, prior to chemical cleaning. Repeatedly flush at short intervals until twice the system water capacity has been flushed through. Chemically clean systems immediately following flushing operations. Circulate a solution consisting of Citri-Clean in dilution rates as indicated by manufacturer. Completely fill system with cleaning solution; vent system and place in operation, with automatic controls operating and valves fully open. Allow system to reach design operating temperature or an operating temperature designated by the Owner's Representative. Circulate the solution through the system for a minimum of 4 consecutive hours; immediately drain system and flush with clean water until the pH at the farthest drain matches the clean water input. Keep strainers unplugged during cleaning operations. Remove and clean strainer screens prior to operational test. Refill system with clean water.
2. Operational Test: Run system in an automatic mode for a minimum of 120 consecutive hours. During this time, make final adjustments, including the setting of the balancing valves.

B. Propylene Glycol Systems:

1. Clean as specified for circulating water systems.
2. Drain system and refill with water/propylene glycol mix. Add water or glycol as needed to obtain required mixture level.
3. Perform operational test as specified for circulating water systems with propylene glycol solution in system.

C. High Temperature Water Piping Systems:

1. Cleaning:
   a. Upon completion of pressure and miscellaneous tests, steam clean piping systems.
   b. Provide temporary piping as required to facilitate the cleaning operations. Include drain valves at low points in the temporary piping arrangement with waste piping from each drain valve, terminating at approved points of waste where directed.
   c. Subject piping system to a steam pressure of 10 psig for a period of 8 hours. During the 8 hour cleaning period, crack the drain valves open. At times as directed, fully open drain valves to blow down the system; repeat this procedure until the piping is declared clean by the Owner's Representative.
   d. Provide a temporary steam generator, with necessary appurtenances, of capacity to supply and maintain a 10 psig steam pressure on the piping system for steam cleaning purposes. Water and electric power will be available at the building, in which the piping system is installed.
   e. Remove the temporary equipment and appurtenances upon completion of cleaning.
2. Operational Test: Run system in an automatic mode for a minimum of 120 consecutive hours. During this time, make final adjustments.

3.04 DUCT SYSTEM AND EQUIPMENT CLEANING

A. Duct Systems:

1. Use service openings for entry and inspection.
   a. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Ductwork Accessories" for access panels and doors.
   b. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
   c. Remove and reinstall ceiling to gain access during the cleaning process.

2. Particulate Collection and Odor Control:

   a. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for O.3-micron-size (or larger) particles.
   b. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

B. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

C. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.05 REFRIGERATION SYSTEMS - TESTING, DEHYDRATION AND CHARGING

A. Leak Test Procedure:
1. Refrigerant Piping Systems:
   a. Pressurize with dry nitrogen to 50 psig and test for leaks using a bubble type solution.
   b. Release this partial test pressure and correct deficiencies.
   c. Charge system with a trace of refrigerant to 15 psig, then add dry nitrogen until system test pressures are reached and retest for leaks with an electronic leak detector.
   d. Release pressure, repair leaks and retest as necessary until no leaks occur.
   e. Recover refrigerant used for leak testing.
2. System Test Pressures:
   a. Charge system with dry nitrogen and trace of refrigerant (HFC 134A, HFC 245, HFC 404, HFC 407C, HFC 410A or HFC 507) to 350 psig and retest for leaks with an electronic leak detector. The system must stay at 350 psig pressure for 24 hours to pass the system test pressure test.
   b. Release pressure, repair leaks and retest as necessary until no leaks occur.
   c. Recover refrigerant used for leak testing.

B. Dehydration:
   1. Low and Ultra Low Temperature Refrigeration Systems (-30 degrees F to 32 degrees F:
      a. Following pressure tests, dehydrate each system with a vacuum pump.
      b. Draw and hold an initial vacuum of 800 microns. Break this vacuum by pressurizing with dry nitrogen to 10 psig, and change oil in vacuum pump.
      c. Draw and hold a second vacuum of 500 microns. Break this vacuum by pressurizing with dry nitrogen to 10 psig, and change oil in vacuum pump.
      d. Draw and hold a third vacuum of 250 microns for 8 to 12 hours with an allowable maximum rise of 50 microns. Break this third vacuum by adding liquid refrigerant specified for the equipment to the high side of the system (liquid line).
      e. Verify vacuum obtained with an electronic vacuum gage.
   2. Medium Temperature Refrigeration Systems (33 degrees F to 55degrees F), and Air Conditioning Systems:
      a. Following pressure tests, dehydrate each system with a vacuum pump.
      b. Draw and hold an initial vacuum of 500 microns. Break this vacuum by pressurizing with dry nitrogen to 10 psig, and change oil in vacuum pump.
      c. Draw and hold a second vacuum of 500 microns. Break this vacuum by pressurizing with dry nitrogen to 10 psig, and change oil in vacuum pump.
      d. Verify vacuum obtained with an electronic vacuum gage.

C. Refrigerant Charging: Follow equipment manufacturer's printed charging directions unless otherwise specified.
   1. Introduce refrigerant of type and quantity required through a filter/drier installed in the temporary charging line.
      a. Purge small amount of liquid out of the system side of the charging hose.
      b. Prevent moisture and other contaminants from entering the system.
   2. Charge liquid refrigerant through a charging valve provided in the high pressure side of the system.
      a. Small amounts of gaseous refrigerant may be charged through the compressor suction service valve port.
   3. No bubbles shall appear at the moisture-liquid indicator when the system is fully charged and operational. Do not overcharge.
   4. Record the weight in pounds of refrigerant charged into each system and submit this record to the Owner.

E. Adjustments and Operational Testing:
   1. Adjustments: Place the system in operation with automatic controls functioning. Adjust controls and apparatus for proper operation. Test thermometers and gages for accuracy over the entire range. Remove and replace items found defective.
      a. Check belts, fan blades, fittings, TXV bulbs, and electrical connections for tightness before start up.
      b. Check TXV bulb for proper location should be between 8 and 10 o'clock or 2 & 4 o'clock.
      c. Seal off all holes in the condition space as specified.
      d. Provide a point to point control check of the system to ensure that the specified inputs and outputs are receiving the signal from the proper sensors or controlling the proper device.

e. Set pressure controls and safety controls.
f. Close or de-energize all solenoids, and start up the system.
g. Check that all controls and safety switches are operating properly.
h. Adjust TXV for proper super heat back to the compressors.
i. Clean TXV strainers as many times as required.
j. After one week of run time, change the liquid cores if they are the replaceable type.
k. After one month of run time, replace the liquid cores and compressor suction socks. Replace the liquid cores as required. Clean the TXV's as required.

2. Operational Test:
   a. Place system in operation, with final connections to equipment and with automatic controls operating, and operate for a minimum of 120 consecutive hours.
   b. Operational test shall prove to the satisfaction of the Owner that the system can produce the cooling effect required by the drawings and the specifications.

3.06 INSTALLATION

A. Automatic Glycol Feed Package, complete with valves and piping, as recommended by the equipment manufacturer and indicated on the drawings.

B. Glycol System(s): following system cleaning, fill specified glycol system and feed tank to indicated percentage of glycol/water solution indicated. Glycol feed tank shall be topped off at project closeout.

C. Connections or extension of existing glycol piping systems: Prior to connecting to the existing system(s), the Mechanical Contractor shall take sample of fluid and provide test reports of the existing fluids concentration of glycol and residuals to the Engineer for acceptance. If the test results have not been provided prior to connection, the Mechanical Contractor shall be held responsible in bringing the entire hydronic system within acceptable specifications. The Mechanical Contractor shall top off the new or existing glycol feed tank, at project closeout.

END OF SECTION 230593

SECTION 230594 - BALANCING OF SYSTEMS

PART 1 GENERAL

1.01 SUBMITTALS

A. Quality Control Submittals:

1. Testing, Adjustment and Balancing Reports: Submit final testing and balancing results on applicable report forms, as approved or furnished by the environmental systems balancing council or bureau, which is certifying the independent member agency performing the Work, required by this Section. Each final systems report form shall bear the signature of the person performing the Work and recording the data and the signature of the certified supervisor for the performing agency. Submit simultaneously with the final reports, a list of the instruments used with the last date of calibration for each instrument.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. Provide the services of a certified independent agency for the testing, adjustment and balancing of all air distribution and hydronic distribution systems complete with all connected apparatus and equipment. The agency shall be certified by the Associated Air Balance Council Bureau - AABC, Washington, DC 20005, National Environmental Balancing Bureau - NEBB, Arlington, Va. 22209 or by pre-approval of the engineer.
2. The Work shall be performed by skilled mechanical technicians under the direct supervision of certified personnel in the employ of the independent agency. The supervisor shall be personally certified by the national council or bureau, as approved by the Engineer.

1.03 SEQUENCING AND SCHEDULING

A. Scheduling:

1. Perform environmental systems testing and balancing after cleaning, miscellaneous testing, adjustment and operational testing Work has been completed.
2. Test and balance system during a period of time when outside temperature conditions will impose a significant load on the system; i.e., summer months for air conditioning system, winter months for heating system. Balance and adjust systems accordingly. Return to the site as required.
3. Send written notification to the Owner's Representative a minimum of five days prior to the performance of testing and balancing Work. Perform testing and balancing Work in the presence of the Owner's Representative.

1.04 ACCURACY

A. Outlets and equipment shall be balanced to within 5% of design airflows. Portions of systems unable to be balanced to these criteria shall be brought to the attention of the

Engineer.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. General Information: Test instruments are included in this specification for information only. Balancing of air and hydronic systems shall be performed by qualified personnel utilizing company owned test instruments, which will remain the property of the company. Use test instruments which are in first class operating condition, with individual calibration histories to guarantee their accuracy. Test instruments shall be of type and kind as required by the type of system installed. Trade names and manufacturer's names are mentioned in this section for descriptive purposes only; instruments of equivalent range and capabilities may be utilized.

B. Air Balancing Instruments:

1. Manometers: Inclined with ranges of 0 to 1/4" and 0 to 1"; Combination inclined and vertical with a range of 0 to 5" and U tube type, 18".
2. Portable "Magnehelic" Draft Gages: Ranges 0 to 1/2", 0 to 1" and 0 to 5".
3. Anemometers: Deflecting vane type with a range of 100 to 3000 fpm, similar to Alnor Velometer Model 6000 BP and 4" diameter rotating vane type.
4. Pitot Tubes: ASHRAE standard type, stainless steel, 5/16" diameter, lengths as required.
5. Sling Psychrometer.
6. Smoke Candles and Smoke Generator.
7. Flowhoods with hoods to match air outlet sizes used on project.

C. Hydronic Balancing Instruments:

1. Calibrated Test Gages: Ranges 0 to 30 lbs., 0 to 60 lbs., 0 to 200 lbs.
2. Calibrated Test Gages (Compound Type): Ranges from -30" to 30 lbs. and -30" to 60 lbs.
3. U Tube Manometer: 36".

D. Air and Hydronic Systems Balancing Instruments:

1. Thermometers: 12" mercury column type and dial type, with a range of -40 to +120 degrees F. and 0 to 220 degrees F. Total of four thermometers.
2. Universal Hand Tachometer: Herman H. Sticht Type UH.
3. Stop Watch.
4. Stroboscope.
5. Contact Pyrometer: Thermocouple type.
6. Volt-Ohm-Ammeter Test Kit, High Current Type: Sperry "Ohmprobe".
7. Volt-Ammeter: With leads for connecting to lugs.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Inspection: Prior to the environmental testing and balancing of hydronic and air distribution systems, the certified supervisor in the employ of the testing and balancing agency shall inspect the installations and notify the Owner's Representative of any Work which must be performed or modified prior to initiating testing and balancing procedures.

B. Performance: Test and balance environmental hydronic and air distribution systems, including all connected equipment and apparatus, so as to conform to the design conditions. Perform the Work of this section in accordance with the published standards of the balancing council or bureau, which is certifying the member firm. Record all test readings, calculations and results.

END OF SECTION 230594

SECTION 230713 - DUCT INSULATION

PART 1 GENERAL

1.01 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Insulation Schedule: Schedule shall list all systems and indicate by system the type of insulation, jacketing, etc, to include manufacturer's model number and size for each service application.

C. Product Data for each Insulation type. Manufacturer's catalog sheets, specifications, and installation instructions for each item specified, excluding Miscellaneous Materials.

1.02 QUALITY ASSURANCE

A. Qualifications: The persons and supervisors performing the Work of this section shall be personally experienced in installing insulation and shall have been regularly performing such work for a minimum of 3 years while in the employ of a company or companies engaged in the installation of piping insulation.

B. Regulatory Requirements:

1. Fire and Smoke Hazard Ratings: Duct insulation installed inside a building, duct lining materials, Class 1 and 2 jacketing materials, mastics, and adhesives shall have a maximum flame spread rating of 25 and a maximum fuel contributed and smoke developed rating of 50 or less, when tested in accordance with ASTM E84 and UL723.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A. Insulation for ductwork shall be fibrous glass with a factory applied laminated foil - scrim - kraft jacket of Class as specified and as follows:

1. (Type-1) Fiberglass Board insulation with a factory applied Class 1 jacket. Preformed, flat, rectangular rigid material, R-Value as specified, having a density of 3.0 pcf, a thermal conductivity (k value at 75 degrees F.) of 0.23 conforming to ASTM C612, with a factory applied Class 1 jacket.

2. (Type-2) Fiberglass Flexible Board insulation with a factory applied Class 1 jacket. Preformed, flat, rectangular rigid material, R-Value as specified, having a density of 3.0 pcf, a thermal conductivity (k value at 75 degrees F.) of 0.23 conforming to ASTM C612, with a factory applied Class 1 jacket.

3. (Type-3) Fiberglass Blanket insulation with a factory applied Class 2 jacket. Roll type, flexible material, R-Value as specified, having a density of 1.0 pcf, a thermal conductivity (k value at 75 degrees F.) of 0.27, conforming to ASTM

C553 with a factory applied Class 2 jacket.

4. (Type-4) Flexible Sheet Foam Plastic insulation. Chemically expanded unicellular elastomeric material possessing the following physical characteristics: R-Value as specified. Flexible sheet form having a density of 6 pcf; a thermal conductivity (k value at 75 degrees F.) of 0.28 max.; operating temperature range of -20 to 200 degrees F., and a self-extinguishing fire resistance rating in accordance with ASTM D1692. Provide UV protective for all outdoors installations and indoors where exposed to sunlight.

B. Insulation Values: Provide the specified insulating value as required, the insulation value shall be the **installed** R-Value

2.02 JACKET MATERIALS

A. When conditions permit, factory applied jacketing materials to insulation.

B. Laminated Jacket:

1. (Class-1) Permanent, fire resistant, non-corrosive type having a UL flame spread rating of 25 or less, a fuel contributed and smoke developed rating of 50 or less, a vapor transmission rate of 0.02 perms or less. Jacket materials shall be as follows:
    i. (Class-1) - Heavy duty 0.7 mil thick aluminum foil and white kraft paper laminate, reinforced with glass fiber scrim or fiber glass yarn, not less than 4 per inch in both directions.

C. Waterproof Membrane:

2. (Class-3) - Waterproofing, High performance prefabricated 13-ply self-adhering, sheet-type waterproofing membrane with flexible aluminum material. Jacketing shall perform –30 degF to +300 degF service temperature. Zero weather and vapor moisture permeability, high puncture / tear resistance, mold inhibiting agents. Apply materials in complete accordance with the manufacturer's printed instructions manual. Furnish color (aluminum or white) as directed by Architect. Provide VentureClad Plus 1579CW or acceptable equal.

    i. Install membrane on board type insulation when ductwork is exposed to the elements outside a building and where noted.

B. Aluminum Jacket

1. (Class – 4) – Aluminum Jacket: ASTM B 209, 3003 Alloy, H-14 temper, factory cut and rolled to indicated sizes.

    i. Finish and Thickness: Smooth finish, 0,016 inch thick.

    ii. Moisture Barrier: 3-mil Dupont Surlyn.

2.03 ADHESIVES, SEALANTS AND CEMENTS: (Cereal base adhesives will not be accepted).

A. Vapor Seal Adhesive: B. Foster 85-20, Childers' CP-82, or Epolux Cadaprene 400.

B. Vapor Barrier Mastic: B. Foster 30-35, Childers' CP-30, or Epolux Cadalar 670.

C. Joint Sealer for use with Fibrous Glass Insulation: B. Foster 30-45, Childers' CP-30 or Epolux Cadalar 670.

D. Adhesive for Flexible Foamed Plastic: Armstrong Cork Co. 520, B. Foster 82-31, Childers' CP-80 or Epolux Cadaprene 488.

2.04 MISCELLANEOUS MATERIALS

A. Duct and Equipment Insulation Fasteners: Weld pin type complete with a speed washer, or suitable clip for supporting the insulation. Fasteners shall be Graham Weld Pins, Duro Dyne Spotter Pins or Clip Pins.

B. Sealing Tape for Sealing Joints in Duct Insulation: Same materials as the jacket, as manufactured by Arno Adhesive Tapes, Inc., Compac Corp., Fasson or Morgan Adhesive Company.

C. Metal Corner Angles: 2" x 2" x 28 gage galvanized sheet metal.

D. Prefabricated Metal Corner Angle Tape: Minimum 28 gage flexible metal bonded to vapor barrier material of the same Class as the insulation jacketing material.

E. Ductwork Insulation Filler Pieces: Preformed, flat, rectangular material, of thickness as specified, having a density of 6 pcf, conforming to ASTM C612.

PART 3 EXECUTION

3.01 PREPARATION

A. Preliminary Work: Clean and dry ductwork, prior to insulating.

3.02 INSTALLATION, GENERAL

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions, except as specified otherwise

3.03 INSTALLATION

A. General: Provide insulation as scheduled below, as a minimum, insulate all HVAC systems provided in this project in compliance with 2020 Energy Conservation Construction Code of New York State / New York City. Where the insulation scheduled or noted in the construction documents exceeds the Energy Code, the greater requirement shall be provided. HVAC Systems provided but not indicated in the schedule below, however require insulation per the Energy Code, shall be provided as part of this project.

APPLICATION	MAT'L	THICKNESS / [Min. R-VALUE]	JACKET	ADD'L JACKET
Supply Duct				
Above ceilings	Type-3	2" [R-6]	Class-1	
Above ceilings, under insulated roofs.	Type-3	2" [R-6]	Class-1	

Above insulated ceilings, under roofs	Type-1	3" [R-12]	Class-1	
Exposed in finished spaces (1)	Type-1	1-1/2" [R-6]	Class-1	
Exposed in un-finished spaces (2)	Type-1	1-1/2" [R-6]	Class-1	
Exterior of the building, Rectangular duct construction.	Type-1 or 4	3" [Min R-12] (7)	Class-1	Class-3
Exterior of the building, Round duct construction	Type-1 or 4	3" [R-12]	Class-1	Class-3
Exposed in un-conditioned spaces	Type-1	1-1/2" [R-6]	Class-1	
Non accessible, un-conditioned spaces (4)	Type-1	3" [R-12]	Class-1	
Return Duct				
Above ceilings	None			
Above ceilings, under insulated roofs.	None			
Above ceilings, return air plenums	None			
Above insulated ceilings, under roofs	Type-1	3" [R-12]	Class-1	
Exposed in finished spaces (1)	Type-1	1-1/2" [R-6]	Class-1	
Exposed in un-finished spaces (2)	Type-1	1-1/2" [R-6]	Class-1	
Exterior of the building, Rectangular duct construction.	Type-1 or 4	3" [Min R-12] (7)	Class-1	Class-3
Exterior of the building, Round duct construction	Type-1 or 4	3" [R-12]	Class-1	Class-3
Exposed in un-conditioned spaces	Type-1	1-1/2" [R-6]	Class-1	
Non accessible, un-conditioned spaces (4)	Type-3	3" [R-12]	Class-1	
OA Duct				
Above ceilings	Type-3	2" [R-6]	Class-1	
Exposed in finished spaces	Type-1	1-1/2" [R-6]	Class-1	
Exposed in un-finished spaces (2)	Type-1	1-1/2" [R-6]	Class-1	
Exposed in un-conditioned spaces (3)	Type-1	1-1/2" [R-6]	Class-1	
Non accessible, un-conditioned spaces (5)	Type-3	3" [R-6]	Class-1	
Exposed in un-conditioned OA mixed with RA	Type-1	1-1/2" [R-6]	Class-1	
OA mixed with RA Duct (8)				
Above ceilings	Type-3	2" [R-6]	Class-1	
Exposed in finished spaces	Type-1	1-1/2" [R-6]	Class-1	
Exposed in un-finished spaces (2)	Type-1	1-1/2" [R-6]	Class-1	
Exposed in un-conditioned spaces (3)	Type-1	1-1/2" [R-6]	Class-1	
Non-accessible, un-conditioned spaces (5)	Type-3	2" [R-6]	Class-1	
Exposed in un-conditioned OA mixed with RA	Type-1	1-1/2" [R-6]	Class-1	
Exhaust Air Duct				
Above ceilings (6)	Type-3	2" [R-6]	Class-1	
Exposed in finished spaces (6)	Type-1	1-1/2" [R-6]	Class-1	
Relief Air Duct				
Above ceilings (6)	Type-3	2" [R-6]	Class-1	
Exposed in finished spaces (6)	Type-1	1-1/2" [R-6]	Class-1	

Comments

1) Ductwork serving the same space in which it serves, and is exposed to view, duct insulation is not required. When ductwork is exposed to view, but does not serve the space where exposed, ductwork shall be insulated as scheduled.
2) Unfinished spaces, which are considered utility use, such as: Boiler rms, mechanical equipment, fan rms, electrical rms, store rms, janitor, basements, and service passages.
3) Un-conditioned spaces: which have no heating or cooling means, such as garages, loading docks.
4) Provide jacket to 96" AFF.
5) Non-accessible and unconditioned spaces: crawl spaces, above ceilings of spaces not conditioned
6) Ductwork between exterior of the building and damper (control or back draft).
7) Provide on flanged duct, one layer 1-1/2" board without vapor barrier between duct flanges followed by a continuous layer of 1-1/2" board with vapor barrier, with the exterior membrane wrap applied.
8) OA mixed with RA, defined as: OA non-tempered outside air (IE: heated or cooled by mechanical means) combined with RA (return air) ductwork.

B. Board Insulation:

1. Board Insulation Application:
   a. Secure insulation to ductwork, with duct insulation fasteners spaced 3" in from all corners of ducts, with intermediate fasteners on maximum 16" centers in all directions. Butt all edges of insulation and fill all voids with similar insulation.
   b. Install board type insulation with a Class 1 jacket. When ductwork cross seams, angle bracing or reinforcing are higher than the insulation thickness, increase insulation thickness to be equal to or greater than the H (height) dimension of the cross seam, angle bracing or reinforcing member.
   c. Seam minimum 1½" wide longitudinal jacket laps continuously with vapor barrier lap adhesive. Lap circumferential joints with 4" wide jacket material and seal laps continuously with vapor barrier lap adhesive, or seal continuously with a minimum 3" wide pressure sensitive sealing tap, of the same material as the jacket. Install metal corner angles or prefabricated corner angle tape, over the jacketed insulated corners. Seal exposed ends of insulation with vapor barrier mastic. Vapor seal all breaks in vapor barrier jacketing, all exposed surfaces of duct insulation fasteners and metal corner angles, with pressure sensitive sealing tape of the same material as the jacket or coat with vapor barrier mastic.
   d. Trapeze Hangers: Place trapeze hangers, fabricated of steel rods and structural steel channels or angles, outside the jacketed insulated ducts. Install high-density insulation pieces, of thickness equal to the insulation, a minimum of 4" in width by the bottom dimension of the duct, at all points of support. Continuously jacket all insulated ducts and filler pieces through all supports.
   e. Miscellaneous Board Insulation Application: Insulate air handling equipment, not furnished with a factory applied insulated jacket or

internal insulation as specified under sections of this specification, with fibrous glass board with a Class 1 jacket, installed and finished as specified for exposed ductwork in a finished space.

f. Provide Flexible board: When surface applications are not conducive for the use rigid board insulation. For use on round or radius equipment or ductwork. Application of flexible board insulation shall be as directed for rigid board application.

C. Blanket Insulation:

1. Blanket Insulation Application: Install insulation with all longitudinal joints overlapped a minimum of 2" and butt or lap all circumferential joints. Secure longitudinal and circumferential joints with flare door staples. Install duct insulation fasteners on the bottom side of all horizontal duct runs, when the bottom dimension of the duct is in excess of 32" in width. Install duct insulation fasteners on the sides of all duct risers having a dimension over 24" in size. Space fasteners in accordance with the following schedule:

DUCT DIMENSION	SPACING OF FASTENERS (Min.)
Up to 32”	None required on horizontal runs, 1 row – 16” on center on all duct riser sides over 24” in size.
33” to 48”	2 rows – 16” on centers
49” to 60”	3 rows – 16” on centers
61” and over	16” on center in all directions.

2. Trapeze Hangers: Place trapeze hangers, fabricated of steel rods and structural steel channels or angles, outside the jacketed insulated ducts. Install high-density insulation pieces, of thickness equal to the insulation, a minimum of 4" in width by the bottom dimension of the duct, at all points of support. Continuously jacket all insulated ducts and filler pieces through all supports.

D. Bench Insulated Ductwork:

1. Insulate ducts prior to erection in place when ducts are required to be installed proximate to walls, ceilings, equipment, structural steel or other ductwork, which will not permit adequate space for the installation of insulation, at a later date. Exercise reasonable care in the installation of bench insulated ductwork, so that insulated surfaces are in perfect condition before and after installation.

3.04 SCHEDULE OF ITEMS NOT TO BE INSULATED

A. Do not insulate the following ductwork items:

1. Return fans.
2. Exhaust fans.
3. Flexible fabric ductwork connections.
4. Sound absorbers.

Note: Provide exterior duct insulation on lined ductwork. The exterior duct insulation R-value may be reduced such that the minimum combined R-value of the liner and ext insulation meets or exceeds minimum required R-value.

3.05 FIELD QUALITY CONTROL

A. Field Samples: The Owner may at their discretion, take field samples of installed insulation for the purpose of checking materials and application. Re-insulate sample cut areas.

END OF SECTION 230713

SECTION 230719 - PIPING INSULATION

PART 1 GENERAL

1.01 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Insulation Schedule: Schedule shall list all systems and indicate by system the type of insulation, jacketing, etc, to include manufacturer's model number and size for each service application.

C. Product Data for each Insulation type. Manufacturer's catalog sheets, specifications, and installation instructions for each item specified, excluding Miscellaneous Materials.

1.02 DEFINITIONS

A. Cold Service Insulation: Insulation on piping and/or equipment conveying fluids at below ambient temperatures.

B. Hot Service Insulation: Insulation on piping and/or equipment conveying fluids at above ambient temperatures.

C. Dual temperature service shall follow cold service requirements.

1.03 QUALITY ASSURANCE

A. Qualifications: The persons and supervisors performing the Work of this section shall be personally experienced in installing insulation and shall have been regularly performing such work for a minimum of 3 years while in the employ of a company or companies engaged in the installation of piping insulation.

B. Regulatory Requirements:

1. Insulation installed inside buildings, including laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.

PART 2 PRODUCTS

2.01 INSULATION

A. (Type-A) Fibrous Glass (Mineral Fiber) Insulation: Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.

1. Preformed Pipe Insulation: Minimum density 3 pcf; ASTM 547:
   a. Class 1 (Suitable for Temperatures Up to 450 degrees F): K of 0.26 at 75 degrees F.
2. Premolded Fitting Insulation: Minimum density 4.0 pcf, K of 0.26 at 75 degrees

F; ASTM C 547, Class 1.

3. Insulation Inserts for PVC Fitting Jackets: Minimum density 1.5 pcf, K of 0.28 at 75 degrees F; ASTM C 553, Type III.
   a. Suitable for temperatures up to 450 degrees F.

B. (Type-B) Flexible Elastomeric Foam Insulation:

1. FM tested and approved, meeting the following:
   a. Maximum Water Vapor Transmission: 0.10 perm - inch based on ASTM E 96, Procedure A.
   b. K of 0.27 at 75 degrees F based on ASTM C 518 or C 177.
   c. Fire Spread/Smoke Developed Rating: 25/50 or less based on ASTM E 84.
2. Pipe Insulation: ASTM C 534, Type I.
3. Polyethylene and polyolefin insulation is not acceptable.

2.02 JACKET MATERIAL

A. All Purpose Jacket: Vapor barrier type, factory or field applied over fiberglass insulation, comprised of a Kraft paper outer cover bonded to aluminum foil, and reinforced with fiberglass yarn. Jacket material shall be treated for permanent fire and smoke resistance. A vapor barrier jacket seal shall be accomplished with a 1-1/2" longitudinal flap, and 3" wide butt strips, factory supplied, for making circumferential joints.

1. Fire and Smoke Hazard Classification Rating (composite, including jacket and adhesive, ASTM E-84):
   a. Flame Spread: 25 or less.
   b. Smoke Developed: 50 or less.
2. Water Vapor Permeability (ASTM E-96): 0.02 perm.
3. Tensile Strength: 40 lb./in. width.
4. Mullen Burst: 70 psi.

B. Aluminum Jacket: ASTM B 209, 3003 Alloy, H-14 temper, factory cut and rolled to indicated sizes, fittings and pipe. As manufactured by: ITW Insulation Systems Houston Texas, Pabco-Childers or approved

1. Finish and Thickness: Smooth finish, 0.016 inch thick.
2. Moisture Barrier: 3-mil Dupont Surlyn.

C. Waterproof Membrane:

Waterproofing, High performance prefabricated 13-ply self-adhering, sheet-type waterproofing membrane with flexible aluminum material. Jacketing shall perform –30 degF to +300 degF service temperature. Zero weather and vapor moisture permeability, high puncture / tear resistance, mold inhibiting agents. Apply materials in complete accordance with the manufacturer's printed instructions manual. Furnish color (aluminum or white) as directed by Architect. Provide VentureClad Plus 1579CW or acceptable equal.

2.03 FITTING INSULATION

A. Fiberglass Insulation System:

1. Pre-molded fitting insulation: Same thickness as the adjacent pipe covering.
   a. Conform to FS-HH-I-558C, Form E, Class 16.
2. PVC/Fiberglass Fitting Insulation: Polyvinyl chloride pre-molded flexible fitting cover with batt type, pre-cut fiberglass insert.
   a. PVC: Conform with FS L-P-535C, Composition A, Type II, Grade GU.
   b. Fiberglass: Conform with FS HH-I-558C, Form B, Type I, Class 7&8.
3. Miter Cut Fitting Insulation: Fabricated from materials employed for pipe insulation.

B. Flexible Elastomeric Foam Insulation System: Miter cut fitting insulation, fabricated from materials employed for pipe insulation.

2.04 MISCELLANEOUS MATERIALS

A. Adhesive:

1. Vapor Barrier Jacket Adhesive: Foster Products Division, 85-20, Childers, CP-82, Epolux, Cad-o-prene, 400.
2. Reinforcing Membrane Adhesive: Foster Products Division 30-36; Childers, CP-50; Epolux, Cadalag 336.
3. Flexible Elastomeric Foam Adhesive: Foster Products Division, 85-75; Epolux, Cad-o-prene, 488; Armstrong, 520.

B. Joint Sealant for Fiberglass Insulation: Foster Products Division, 30-45; Childers, CP-30; Epolux, 670.

C. Vapor Barrier Coating: Foster Products Division, 30-35; Childers, CP-30; Epolux, 670.

D. Cement:

1. Insulating Cement: ASTM C195, asbestos free.
2. Finishing Cement: ASTM C449/C449M.

E. Reinforcing Membrane:

1. Polyester Cloth: 8 x 8 mesh per sq. in., 0.7 oz. per sq. yd.; Foster Products Division, Mast-a-fab.
2. Glass Yarn Cloth: 20 x 20 mesh per sq. in.; Johns-Manville, Duramesh fabric.

F. Sealing Tape: Vapor barrier, color matching, of same material as the pipe or fitting cover to which applied; as manufactured by Arno Inc., Compac Corp., Fasson Adhesive Co.; or as recommended by the manufacturer of the jacket material to which applied.

G. Banding Wire: Steel, 20 gauge, galvanized; annealed.

H. Thumb Tack Fastener: Stainless steel, with serrated shank.

I. Insulation Inserts (for Hangers and Supports):

1. Inserts, High Density Insulation for use with Fibrous Glass Insulation:

a. Cold Service Piping:
i. Polyurethane Foam: Minimum density 4 pcf, K of 0.13 at 75 degrees F, minimum compressive strength of 125 psi.
b. Hot Service Piping:
i. Calcium Silicate: Minimum density 15 pcf, K of 0.50 at 300 degrees F; ASTM C 533.
ii. Perlite: Minimum density 12 pcf, K of 0.60 at 300 degrees F; ASTM C 610.

3. Inserts for use with Elastomeric Foam Insulation only:
a. Cold and Hot Service Piping:
i. Hardwood dowels and blocks, length or thickness equal to insulation thickness, other dimensions as specified or required.

J. Wood Blocks: Hardwood, preservative treated; 1" wide, 3" minimum length; inner and outer surfaces contoured to fit the curvature of the pipe, and insulation shield. Wood blocking is not acceptable for use on heating systems with fiberglass insulation, and will require removal if used.

K. Wood Dowel Plugs: Hard wood, preservative treated.

L. Wood Preservative: Pentachlorophenol, 5% solution, 3 minute dip.

PART 3 EXECUTION

3.01 PREPARATION

A. Do not install insulation until the piping Work has been tested and accepted.

B. Clean and dry all Work to be insulated prior to applying insulation.

3.02 INSTALLATION, GENERAL

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions, except as specified otherwise.

3.03 INSTALLATION OF FIBERGLASS INSULATION

A. Seal jacket longitudinal flap with vapor barrier jacket adhesive. Rub out all wrinkles and smooth excess sealant flush with outer surface of jacket.

B. Apply a coating of vapor barrier jacket adhesive to butt ends of each section of insulation to be joined, and apply butt strips in like manner as above. Apply butt strips to overlap 1-1/2" on each side of the sections joined.

C. PVC/Fiberglass Fitting Insulation: Tuck the ends of the pre-cut insulation batt snugly into the throat of the fitting, tuft and tuck-in the edges adjacent to the pipe insulation. Install fitting cover and seal as follows:

1. Cold Service Insulation: Seal the overlap in the throat of the fitting cover, and the butt joint of the cover with the adjacent pipe insulation, with vapor barrier mastic and 2" wide sealing tape (a product of the fitting cover manufacturer).

Extend the tape 1" over the adjacent pipe insulation and overlap upon itself at least 2" on the downward side.

2. Hot Service Insulation: Secure the cover with staples, thumb tack fasteners, or sealing tape.

D. Pre-Molded and Miter Cut Fitting Insulation: Insulate to the same thickness as the adjoining pipe insulation. Apply joint sealant to the mating edges of the sections, and to the butt joint. Secure sections together with banding wire; bend twisted ends into the insulation. Apply a leveling coat of insulating cement to fill the voids and smooth irregularities.

1. Cold Service Insulation: Cover fitting insulation with two 1/8" thick applications of vapor barrier coating, with a layer of reinforcing membrane bedded between coats. Lap membrane at least 2" over itself, and the adjacent pipe insulation. Apply a 6 ounce canvas jacket over the fitting, secured with adhesive. Lap canvas at least 2" over itself, and the adjacent pipe insulation.
   a. Omit canvas on concealed installations.

2. Hot Service Insulation: Apply a 6 ounce canvas jacket to the fitting insulation, secured with adhesive. Lap canvas at least 2" over itself.
   a. Omit canvas on concealed installations.

E. Vapor Stop for Cold Service Insulation:

1. Pipe Insulation: At 21 foot intervals of horizontal, and 9 foot intervals of vertical pipe insulation, also at each fitting insulated with pre-molded or miter cut fitting insulation, apply a 1/16" thickness of vapor barrier coating to the butt end, and 2" into the bore of each joining section before assembling.
2. Insulation Termination; Metal to Insulation Joints; Protrusions Through Insulation:
   a. Apply a vapor barrier coating to completely seal the joint and extend over adjacent insulation and metal a maximum of 3 inches.
   b. Embed reinforcing membrane into the coating, covering the complete coated surface; smooth out wrinkles.
   c. Apply a heavy application of vapor barrier coating over the entire surface, leaving a large bead or fillet at the joint between metal and insulation.

F. Insulated Piping Exposed to view in finished spaces:
1. Provide PVC pipe and fitting jacketing, from 8’-0” aff or finished ceiling (which ever is higher) down to point of concealment.
2. Provide aluminum pipe and fitting jacketing, from 8’-0” aff or finished ceiling (which ever is higher) down to point of concealment.

G. Insulated Piping installed exterior to the building, exposed to the elements:

1. Pipe supports shall not be in direct contact with pipe, supports must to the exterior of the insulation and jacketing.

2. Provide continuous PVC pipe and fitting jacketing, caulked / sealed weather tight, from exit point of building to termination point (to include termination connections).

3. Provide continuous Waterproof Membrane jacketing on insulated pipe and fittings with insulation OD is 6” or larger, from exit point of building to termination point (to include termination connections).

4. Provide continuous Aluminum pipe and fitting jacketing, caulked / sealed weather tight, from exit point of building to termination point (to include termination connections).

3.04 INSTALLATION OF FLEXIBLE ELASTOMERIC FOAM INSULATION

A. Where possible, slip insulation over the pipe, and seal butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and install; re-seal with adhesive, making sure the mating surfaces are completely joined.

B. Insulate fittings and valves with miter cut sections. Use templates provided by the manufacturer, and assemble the cut sections in accordance with the manufacturer's printed instructions.

1. Insulate threaded fittings and valves with sleeved fitting covers. Over lap and seal the covers to the adjoining pipe insulation.

C. Carefully mate and seal with adhesive all contact surfaces to maintain the integrity of the vapor barrier of the system.

D. Insulated Piping installed exterior to the building, exposed to the elements:

1. Pipe supports shall not be in direct contact with pipe, supports must to the exterior of the insulation and jacketing.

2. Apply two coats of weatherproof mastic, on piping where the insulation OD is 3” or less.

3. Provide continuous PVC pipe and fitting jacketing on piping where the insulation OD is 4” or larger, caulked / sealed weather tight, from exit point of building to termination point (to include termination connections).

4. Provide continuous Waterproof Membrane jacketing on insulated pipe and fittings with insulation OD is 6” or larger, from exit point of building to termination point (to include termination connections).

5. Provide continuous Aluminum pipe and fitting jacketing, caulked / sealed weather tight, from exit point of building to termination point (to include termination connections).

3.05 INSTALLATION AT HANGERS

A. Reset and realign hangers and supports if they are displaced while installing the piping insulation.

B. Direct hanger or clamp contact of pipe for hot or cold piping is not allowed.

C. Fiberglass Insulation: Install high density insulation filler pieces, at all points of support, between pipe insulation shields and pipe or tubing on pipe or tubing 2" and larger. Do not install high-density insulation filler pieces on piping or tubing scheduled to have steel saddles. Install filler pieces of the same thicknesses as adjoining pipe insulation and 2" longer than the insulation shield of the following materials:

1. Install high density molded polyurethane or high-density polystyrene filler pieces, for pipe or tubing insulated with fiberous glass.

D. Flexible Elastomeric Foam Insulation: Install wood blocking or wood dowel plug filler pieces of the same thickness as the insulation. Slot the insulation, insert the filler pieces between the pipe and insulation shield, and secure in place with adhesive. Install filler pieces as follows:

PIPE/TUBING SIZE	FILLER PIECES	POSITION
Thru 1½"	2 dowel plugs	6 o'clock; in tandem
2" thru 4"	1 block 2 dowel plugs	6 o'clock, and 4&8 o'clock, respectively
6" thru 8"	2 blocks 4 dowel plugs	6 o'clock; in tandem and 4&8 o'clock; in tandem

3.06 INSULATION SCHEDULES

A. General: Provide insulation as scheduled below, insulate all HVAC systems provided in this project in compliance with NYS Energy Code. Where the insulation scheduled or noted in the construction documents exceeds the Energy Code, the greater requirement shall be provided. HVAC Systems provided require insulation per the Energy Code, but not indicated in the schedule below, shall be insulated as part of this project..

APPLICATION	PIPE SIZE	TYPE	MINIMUM THICKNESS	ADD'L
Hot Water (HWS & HWR)	1-1/4" or less	A	1½"	
	1-1/2" and above	A	2"	
Chilled Water (CWS & CWR)	1-1/4" or less	A or B	½"	
	1-1/2" and above	A or B	1"	
Condensate Drain (CD)	1-1/4" or less	A or B	1/2"	
	1-1/2" and above	A or B	1"	
Refrigerant	1-1/4" or less	B	1½"	
	1-1/2" and above	B	2"	

Insulate all cold and hot service equipment in accordance with the schedule, except the items listed below:

A. Air vents, pressure reducing valves, pilot lines, safety valves, relief valves; back pressure valves.

B. Flexible connectors.
C. Piping buried in the ground, unless otherwise specified herein.
D. Items installed by others, unless otherwise specified herein.

B. Install all cold and hot service insulation intact through pipe sleeves, and openings in building construction, maintaining the vapor barrier integrity of the system.

C. Insulate valve bodies up to but not including the packing nuts.

D. Flanges and mechanical couplings and fittings (grooved fittings) shall be insulated with the insulation thickness specified for that system. Provide molded PVC fitting on all grooved fittings.

E. Coordinate with the equipment manufacturers requirements, provide field insulated equipment components or system components as recommended (IE: refrigerant line, boiler headers, cross over piping, etc) per manufacturer.

F. Insulation Options: Select only one of the first 3 options for fiberglass pipe and/or equipment insulation. Option 4 may be used for temperatures to 200 degrees F and on sizes of 2 inches and under. Use fiberglass on pipe and equipment sizes of 2-1/2 inches and larger. Do not inter mix insulation types on individual runs of piping.
1. Option 1: Fiberglass pipe and/or equipment insulation, with pre-molded fitting insulation.
2. Option 2: Fiberglass pipe and/or equipment insulation, with PVC/fiberglass fitting insulating system.
3. Option 3: Fiberglass pipe and/or equipment insulation, with miter cut fitting insulation.
4. Option 4: Flexible elastomeric foam pipe and/or equipment insulation, with miter cut fitting insulation.

3.01 FIELD QUALITY CONTROL

A. Field Samples: The Owner may at their discretion, take field samples of installed insulation for the purpose of checking materials and application. Re-insulate sample cut areas.

END OF SECTION 230719

SECTION 230800 - COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.01 OVERVIEW

A. This section of the specifications describes the process for commissioning HVAC systems, defines the responsibilities of the commissioning agent and contractor, and outlines the duties of other members of the commissioning team.

B. The commissioning process shall be applied to all equipment, components, and systems as listed in PART 3, including specified interfaces to and from equipment and systems provided under other divisions.

1.02 SUBCONTRACTORS

A. The appropriate Subcontractors shall be responsible for cooperating and coordinating their work wit the commissioning agent. They shall also be responsible for carrying out all the physical activities required for physical installation of components and systems, and for operating them during the commissioning process.

1.03 COMMISSIONING AGENT

A. The commissioning agent shall be a sub-trade to the contractor or, subject to pre-bid approval by the Engineer, a specific commissioning group within the contractor's staff.

B. The Owner's designated representatives must have the opportunity to observe any or all of the systems functional performance tests as an important element in the operator familiarization and instruction process.

C. If outside air temperature, lack of full occupancy, or other factors prevent full performance testing of some functions, then testing, verifying and documenting the performance of these functions shall be carried out at an appropriate, and mutually agreed upon, time during the 12 months after substantial completion.

PART 2 - THE COMMISSIONING PROCESS

2.01 COMMISSIONING TEAM

A. The commissioning team shall consist of:

1. Commissioning agent
2. Contractor's representative(s)
3. Controls contractor's representative(s)
4. Sheetmetal contractor's representative(s)
5. Fire protection contractor's representative(s)
6. Electrical contractor's representative(s)
7. General contractor's representative(s)
8. Mechanical engineer's representative
9. Electrical engineer's representative

10. Architect's representative
11. Owner's representative(s)

2.02 COMMISSIONING RESPONSIBILITIES

A. The commissioning agent shall:

1. Plan, organize, and implement the commissioning process as specified herein.
2. Prepare the commissioning plan and ensure its distribution during construction.
3. Revise the commissioning plan as required during construction.
4. Chair commissioning meetings and prepare and distribute minutes to all commissioning team members, whether or not they attended the meeting.
5. Coordinate commissioning activities among all contractors, sub-trades and suppliers.
6. Carry out all required system readiness checks and document the results as the checks are done.
7. In cooperation with the controls contractor, ensure all control point checkouts are carried out and the results documented as the checks are done.
8. Observe or verify all start-ups and initial system operations tests and checks, which shall encompass all specified functional performance tests, ensuring the results are documented as the tests and checks are done.
9. At the direction of the Engineer, ensure equipment and systems are operated for functional performance verification purposes
10. Ensure all required instruction and demonstrations are provided to the Owner's designated operating staff.

B. Contractor

1. Within one (1) month of the award of the contract, the contractor shall submit the name of the commissioning agent firm, along with the name of the individual who will be the agent's commissioning coordinator for this project.
2. The contractor, and all his sub-trades and suppliers, shall cooperate with the commissioning agent in carrying out the commissioning process. In this context, the contractor shall:
   a. Provide equipment and systems start-up as required.
   b. Operate equipment and systems as required for both initial systems operations and final functional performance tests.
   c. Attend commissioning meetings, and attend to action items arising from them, as required to allow the commissioning process to proceed on schedule.
   d. Provide instruction and demonstration for the Owner's designated operating staff, in conjunction with the commissioning agent, in order to meet all specified requirements in this regard.

C. Engineer

1. The Engineer will review the commissioning plan. He will also participate, as appropriate, in on-site commissioning meetings.
2. During the functional performance phase of the commissioning process, the engineer will be on-site to review commissioning documentation, witness functional performance tests, and verify acceptable performance or to declare performance unacceptable, as the case may be.

D. Owner

1. The Owner will ensure the availability of operating staff for all scheduled instruction and demonstration sessions. This staff will posses sufficient skills and knowledge to operate and maintain the installation following attendance at these sessions.

E. Commissioning Phases

1. The on-site commissioning process shall be organized and carried out in four phases, as follows:
   a. Phase 1 - system readiness and start-up
   b. Phase 2 - initial operation
   c. Phase 3 - function performance verification
   d. Phase 4 - demonstration and instruction
2. Each phase is applicable to each separate system and its components, as listed in PART 3, including all related controls and specified interfaces to other divisions.

F. Commissioning Plan

1. Within two (2) months of award of the contract, the commissioning agent shall review design intent and intended commissioning procedures with the Engineer.
2. Within three (3) months of award of the contract, but in no event less than three (3) months before scheduled date of substantial completion, the commissioning agent shall submit a detailed commissioning plan to the Engineer,
3. The commissioning plan shall contain the information necessary to document the commissioning process as it progresses from pre-start checks, to start-up and initial operation , and finally to functional performance verification of all systems. The commissioning plan must include detailed checklist relevant to guiding the carrying out and documenting of Phases 1, 2, and 3 of the commissioning process. The design of these checklists should be such that the items to be checked, or the steps to be taken in functional performance testing, are clearly listed. The plan will thus streamline the process and make documentation of it efficient and easy.
4. The commissioning plan shall also contain a schedule of commissioning work, integrated with the general contractor’s overall project schedule. The schedule shall show:
   a. Completion dates for each system or systems in each area of the building.
   b. Dates for controls installation completion and point checkout.
   c. Dates for carrying out Phases 1 and 2 commissioning work for each system or group of systems.
   d. Submission dates for the documentation required by the Engineer prior to Phase 3 verification.
   e. Dates for carrying out Phase 3 commissioning work.

G. Phase 1 - Systems Readiness and Startup

1. Before starting any equipment or systems, complete the system readiness or pre-start checks in the commissioning plan and document the results. The following conditions and items shall be completed as applicable:

a. Piping systems have been pressure tested as specified, found to be tight and reports submitted.
b. Piping systems have been flushed and cleaned as specified, any required reports submitted, and then filled or charged as applicable.
c. Equipment has been lubricated to specifications.
d. Air system cleaning is complete, and particulate filters have been installed.
e. Vibration isolation and seismic restraints have been installed to specification and adjusted.
f. Equipment drives have been aligned.
g. Electric services have been installed and checked.
h. Control point checkouts have been completed.
i. Safety controls have been installed and operation checked.
j. Major equipment start-up has been carried out by manufactures representatives when specified (refer to equipment specification sections) and required start-up reports completed and submitted.

2. All checks shall be documented on the relevant checklist as they are carried out. Deficiencies or incomplete work shall be corrected, and the checks repeated until the installation is ready for operation, before proceeding to Phase 2 of the process.

H. Phase 2 - Initial Operation

1. In Phase 2 of the commissioning process, the contractor, with the commissioning agent verifying, completes the testing, balancing, and calibration of all components and systems. They also operate all systems through all specified modes of operation, and test system responses to specified abnormal or emergency conditions.
2. Work carried out during this phase of commissioning shall include the following, as applicable (note that not all these activities are a direct part of the commissioning process, but they all need to be carried out during or prior to this phase of commissioning):
   a. Air systems balancing, including positioning of all balance dampers, adjustments to diffusers, registers and grilles.
   b. Hydronic systems balancing, including positioning of all balance valves.
   c. Correction of problems revealed during balancing, including changes to fan speeds or blade pitch as necessary.
   d. Setting up and calibrating all automatic temperature controls devices, including adjustments to control valves and damper actuators.
   e. Setting up or programming controls for accurate response and precise sequencing to meet specified performance.
   f. With commissioning agent verifying, the balancing contractor, and controls contractor working together, setting up air flows and controls calibrations for variable volume terminal units and air valves where applicable.
   g. Ensuring final adjustments to vibration isolation and seismic restraints are carried out as necessary.
   h. Checking operation of all fire dampers.
3. As was done in Phase 1, all checks and test shall be documented on the relevant checklists as they are carried out. Deficiencies or incomplete work shall be

corrected, and the checks or tests repeated until correct installation and function has been confirmed and the installation is ready for Engineer verification.

I. Phase 3 - Functional Performance Verification

1. All equipment and systems shall be operated through the entire specified sequence of operations, as directed by the Engineer for witnessing and verifying acceptable operation.
2. During this phase of commissioning, the following checks and tests may be required by the Engineer and shall be allowed for:
   a. Checking the location and accessibility of all access panels.
   b. Operation of all controls systems devices, both sensors and actuators.
   c. Proper physical response of all controlled devices and components to setpoint changes or other relevant adjustments.
   d. Operation of randomly selected fire or smoke dampers.
   e. Demonstration of acceptable noise and vibration levels from any equipment, under its full range of operational conditions.
   f. Operation of equipment and systems under every specified mode of operation and sequence of control
   g. Operation of equipment and systems under normal, abnormal and emergency conditions
   h. Once acceptable performance of HVAC systems has been verified, then operation under specified interfaces to/from equipment and systems provided under other divisions.

J. Demonstration and Instruction

1. The formal demonstration and instruction for operating staff shall commence once the Phase 3 commissioning is complete and substantial completion achieved. Documentation and instruction shall cover all equipment and systems, and their controls.

PART 3 - EXECUTION

3.01 HVAC SYSTEMS - The following systems shall be commissioned:

A. Hot Water, Glycol Solution, Chilled Water, and Condenser Water Piping Systems: Installation checks; pressure tests; expansion tanks; flow balancing verification.

B. Duct Systems: Installation checks; flow balancing verification; leak testing as applicable.

C. Chiller(s): Installation checks; checkout and start-up by manufacturer's representative; performance measurements, including capacity, evaporator and condenser flows, motor amperage, and controls operation (e.g., staging and capacity modulation).

D. Refrigeration Compressor/Condensing Unit(s): Installation checks; checkout and start-up by manufacturer's representative as specified; performance measurements, including capacity, evaporator and condenser pressures, motor current draw, and controls operation.

E. Boiler(s): Installation checks; boil out and chemical treatment; checkout and start-up by

manufacturer's representative; performance measurements, including combustion efficiency, capacity test, burner, and controls operation.

F. Pumps: Checks on alignment, rotation, motor current draw, flows, and pressure.

G. Hydronic Heating: Installation checks; performance measurements and adjustments, including flows, capacity, and control responses.

H. Supply, Return, Relief, and Exhaust Fans: Checks on installation (including dampers and other accessories), rotation, motor current draw, and air flows and pressures.

I. Air Handling Units (Packaged, Rooftop, and Built-up): Installation checks; checkout and start-up by manufacturer's representative for large factory fabrication units; capacity tests for heating, cooling, air flow, and static pressures; operation of all controls.

J. Air Terminal Devices: Installation checks; for variable air volume (VAV) units, flow adjustments and calibration coordinated with controls and air balancing; controls operation, including flow modulation, reheat, controls responses.

K. Fan-Coil Units, unit ventilators, cabinet heaters, and unit heaters: Installation checks; performance and controls check.

L. Controls and EMCS: Installation and operation of all devices; complete operation of all controls sequences in coordination with commissioning of all controlled systems.

END OF SECTION 230800

SECTION 230923 - BUILDING MANAGEMENT SYSTEM

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, tools, equipment, and services for a fully integrated and networked energy management control system (EMS) as indicated, in accordance with provisions of contract documents.

B. The EMS shall be an extension of the existing campus-wide Siemens Energy Management System.

C. Interface to the EMS shall be via the Owner's operator workstation and existing web browser interface. All existing and new functions shall be accessible via the local network and the internet.

D. Provide system graphics for all controlled equipment, each controlled device and floor plan and integrated system. New graphics layout and appearance shall match Owner's existing Siemens system graphics. Origin of information shall be transparent to the operator and shall be controlled, displayed, trended, etc. as if the points were hardwired to the EMS.

E. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intents of this specification, shall be included in Contractor's bid and provided without additional cost to the Owner.

F. A post-bid interview and technical review with the Owner and the Engineer may be required prior to contract award. During this interview the contractor will be required to demonstrate that their proposed solution and specific plan regarding the integration of their controllers with the Owner's Siemens Operator Workstation and existing control system and network fulfills the contract requirements to the satisfaction of the Owner.

G. Existing control wiring may be reused if it is undamaged, installed in accordance with local building codes, local and national electrical codes and "Wiring" section below, and compatible with the energy management system and recommended for use in its new application by the EMS manufacturer. Remove and properly dispose of all unused wiring.

1.02 QUALITY ASSURANCE

A. The EMS shall be installed by competent mechanics and checked out by competent technicians regularly employed by the manufacturer of the equipment or licensed franchises authorized by the manufacturer.

B. Single source responsibility shall include installation, calibration, and check-out of the stand-alone systems and network.

C. The EMS installer shall have an in-place, local support facility with technical staff, spare parts inventory, and all necessary test diagnostic equipment.

1.03 REFERENCED STANDARDS, CODES AND ORDINANCES

A. The latest issue of applicable standards and recommended practices of the following agencies in effect shall form a part of the specification to the extent each agency s relative standards or recommended practices apply to the Systems and its components as specified herein.

1. Federal Communications Commission (FCC)
2. American National Standards Institute (ANSI)
3. American Society of Mechanical Engineers (ASME)
4. Electronic Industries Association (EIA)
5. Institute of Electrical and Electronics Engineers (IEEE)
6. National Electrical Manufacturers Association (NEMA)
7. National Fire Protection Association (NFPA)
8. Underwriters Laboratories (UL)
9. Occupational Safety and Health Administration (OSHA)
10. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

B. All systems equipment, components, accessories, and installation hardware shall be new and free from defects and shall be UL listed where applicable. All components shall be in current production and shall be a standard product of the system or device manufacturer. Refurbished or reconditioned components are unacceptable. Each component shall bear the make, model number, device tag number (if any), and the UL label as applicable. All systems components of a given type shall be the product of the same manufacturer.

1.04 SUBMITTALS & OPERATION AND MAINTENANCE MANUALS

A. Provide shop drawings of the entire control system and submittals on hardware, software, and equipment to be installed or furnished. Begin no work until submittals have been approved for conformity with design intent. Control shop drawings shall contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system.

B. All control system components shall be shown on control shop drawings and shall be identified in respective shop drawing bill of material. Bills of material shall include brief description of each system component, component part number and component device tag.

C. Over- **and** under-voltage protection apparatus for all system controllers as specified in Power Supplies and Power Conditioning later in this document shall be shown on the control shop drawings and identified in the bills of material.

D. Wiring diagrams and layouts for each control panel and terminal identification for all control wiring shall be shown on the control shop drawings.

E. A complete written Sequence of Operation and input/output points list of all points connected to the DDC system shall be included for each piece of controlled equipment. This information shall be located on the associated system control shop drawing or on the page immediately following if the information will not fit on the system drawing.

F. Label control shop drawings and title blocks descriptive of controlled equipment shown on the shop drawing. Do not label shop drawings to match mechanical drawing numbers.

G. Clearly reference covered specification and drawing on each submittal. Product submittals shall consist of a complete list of equipment and materials, including manufacturer's catalog data sheets and installation instructions. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate specific data for the product being submitted by highlighting or by other means. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work.

H. Product submittals shall include manufacturer's product data and specifications for any Operator Workstation; Web browser user interface server or workstation and software; portable operator's terminal; uninterruptible power supply; printer; and networking equipment provided as part of the EMS.

I. Submittal shall include a system schematic riser diagram depicting the building OWS; printers; browser user interface computers / peripherals; Network Area Controllers (NAC); standalone EMS controllers, 3rd party controllers; and the networking equipment required to make a complete and functional system.

J. Upon completion of the work, provide three (3) hardcopy sets of Operation and Maintenance Manuals to the Owner. The entire Operation and Maintenance Manual shall also be furnished on compact disk media. The manuals shall include the following for the EMS provided:

1. Table of contents.
2. As-built system record drawings. Computer Aided Drawings (AutoCAD, recent version) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal. Provide CAD files and PDFs.
3. As-built versions of manufacturers' product data sheets for all products including software.
4. System Operator's manuals with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
5. Licenses, guarantees and warranty documents for equipment and systems.
6. EMS network diagrams.
7. Wiring termination schedules.

8. Interfaces to all third-party products and work by other trades.
9. List of recommended spare parts with part numbers and suppliers.
10. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning and calibration; time between tasks; and task descriptions.

K. As-built software documentation shall be provided on a CD, DVD, or flash drive and include the following:

1. Descriptive point lists.
2. Application program listing.
3. Application programs with comments.
4. Printouts of all reports.
5. Alarm list.
6. Printouts of all graphics.

L. The Operation and Maintenance Manual CD, DVD, or flash drive shall be self-contained and include all necessary software (except AutoCAD) required to access the project record drawings, data sheets, spare parts list and maintenance procedures. A logically organized table of contents shall provide dynamic links to view and print all project record drawings and product data sheets. Viewer software shall provide the ability to display, zoom and search all documents.

M. On-line Documentation: After completion of all the tests and adjustments listed above, the contractor shall install the following information on the EMS:

1. "AS-BUILT" drawing files
2. Detailed catalog data on all installed system components
3. Address and phone number of factory repair service contact

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.02 ACCEPTABLE SUPPLIERS/MANUFACTURERS:

A. Siemens.

2.03 POWER FAIL / AUTO RESTART

A. Provide for the automatic orderly and predefined shutdown of parts of or the entire EMS following total loss of power to parts of or the entire EMS.

B. Provide for the automatic orderly and predefined startup of parts of or the entire EMS following re-establishing of power to parts of or the entire EMS.

C. Maintain the EMS real-time clock operation during periods of power outage for a minimum of 72 hours.

D. Refer to additional Power Fail / Auto Restart requirements in the Sequence of Operation section.

2.04 POWER SUPPLIES & POWER CONDITIONING

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

B. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.

C. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.

D. Line voltage units shall be UL recognized and CSA listed.

E. All system controllers, with the exception of the room VAV box controllers, shall be provided with power conditioning, over-voltage **and** under-voltage protection. Under-voltage protection shall be provided by voltage sensing relays (refer to HVAC field devices) or an uninterruptible power supply sized appropriately by EMS contractor for its protected controllers.

2.05 HVAC FIELD DEVICES:

A. Motorized Control Dampers provided by EMS contractor unless otherwise noted.

B. Control Damper Actuators: Spring-return actuators installed for fail-safe action are required for all dampers. Unless otherwise specified in the Sequence of Operation or on the drawings, dampers utilized in outside, relief and exhaust air applications shall be fail-safe closed; dampers utilized in return air applications shall be fail-safe open; combustion air dampers and emergency generator intake and exhaust air dampers shall be fail-safe open. Actuators shall be electric/electronic sized to match the application with adequate power to operate smoothly and provide tight close-off. Two-position or proportional electric/electronic actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation. Actuators shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS). Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have

a 2-10 Vdc or 4-20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications.) 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring. Operators shall be able to manually position each actuator when the actuator is not powered. Spring-return actuators with more than 60 in.-lb torque capacity shall have a manual crank. Provide one actuator per damper section at a minimum. EMS contractor shall provide all damper actuators unless otherwise specified elsewhere. Low voltage and line voltage wiring to actuators is considered control wiring and shall be provided by the EMS contractor.

C. Control Valves: Spring-return, fail-open action is required for all heating and cooling coil control valves on any equipment that has an outside air source unless otherwise specified in the Sequence of Operation. Select body and trim materials in accordance with manufacturer's recommendations for design conditions and service shown. Water service control valves shall be 2-way or 3-way pattern as specified or shown on the drawings and shall provide tight shutoff against system design pressures and differentials (150% of total pump head for 2-way valves and 100% for 3-way valves). Two-position valves shall be □line□ size. Proportional control valves for water service shall be sized for a maximum pressure drop of 3.0 psi at rated flow (except as may be noted on the drawings). Proportional control valves for steam service shall be sized as appropriate for the application and the inlet steam pressure. Valves providing modulating service shall have equal percentage ports. Valves with sizes up to and including 2 inches shall be □screwed□ configuration and 2-1/2 inch and larger valves shall be □flanged□ configuration. All actuators shall be sized for tight shut-off against system pressures and furnished with integral switches for indication of valve position (open-closed). Electric bi-directional actuators are acceptable on VAV terminal units and room reheat coil valve control. All electric actuators for applications other than VAV terminal units and room reheat coil valve control shall be proportional analog 4-20Ma or 0-10Vdc input. Three-way butterfly valves, when utilized, shall include a separate actuator for each butterfly segment. Low voltage and line voltage wiring to actuators is considered control wiring and shall be provided by the EMS contractor.

D. Wall Mount Room Temperature Sensors: Each room temperature sensor shall provide temperature indication to the digital controller and provide the capability for a software-limited set point adjustment and operation override capability. An integral LCD shall annunciate current room temperature and set point as well as override status indication. In addition, the sensor shall include a port for connection to a portable operatorss terminal. Sensors shall be mounted at 54 inches AFF unless indicated otherwise on drawings.

E. Duct Mount, Pipe Mount and Outside Air Temperature Sensors: 10,000-ohm thermistor temperature sensors with an accuracy of ∀ 0.2□C. or two wire RTD type with nickel wound elements with a minimum of 1000 ohm reference resistance and a minimum accuracy of +/- 0.5 deg F. Outside air sensors shall include an integral sun shield and be mounted on a northern exposure. Immersion sensors shall be provided with a separable brass or stainless steel well, as required by the application. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.

F. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a

current level below trip set point.

G. Power Monitoring Interface: The Power Monitoring Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under UL-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the EMS based on the measurement and calculation of the following parameters: (a) current for each phase and average of all three phases, (b) kW for each phase and total of all three phases, (c) power factor for each phase and all three phases, (d) percent voltage unbalance and (e) percent current unbalance. These output values shall be hard-wired inputs to the EMS or shall be communicated to the EMS over the open-protocol LAN.

H. Water flow meters shall be single turbine insertion-type with frequency output complete with hot-tap isolation valves to enable sensor removal without water supply system shutdown. Accuracy shall be □ ± 0.5% of reading at calibrated velocity. Frequency output 0-15V peak pulse. Meters shall be fully compatible for use as a system with BTU meters as specified below. Flow meter shall be Onicon F-1100, or approved equal.

I. BTU meters shall come complete with temperature sensors and thermowells and be fully compatible for use as a system with water flow meters as specified above. Differential temperature accuracy shall be □ ± 0.15°F over calibrated range. Non-volatile EEPROM memory shall retain all program parameters and totalized values in the event of power loss. Alphanumeric LCD shall display total energy, total flow, energy rate, flow rate, supply temperature and return temperature. Standard output signal shall be isolated solid state dry contact for energy total. Provide with optional 4-20mA analog output for flow rate. BTU meter shall be Onicon System-10 BTU meter, or approved equal.

J. Temperature Control Panels: Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door, key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel. Pre-wire internal and face-mounted device connections with color-coded stranded conductors, tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring. Each local panel shall have a control power source power switch (on-off) with over-current protection. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels.

K. Filter differential pressure switches shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have adjustable scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified. Switches shall be piped across the filter sections and set per the filter manufacturer's recommendations.

L. Filter differential pressure sensing device shall be indicating transmitter type designed to provide both visual monitoring at the filter location and electronic monitoring at the EMS. Transmitter shall have easily-read dial gage and two-wire, 4-20mA control signal with rear-mounted terminal strip. Transmitter shall be Dwyer Magnehelic Differential Pressure Indicating Transmitter Model 605, or approved equal with range appropriate for filter bank and shall be piped across the filter sections. EMS alarm point shall be set per the filter manufacturer's recommendations.

M. Water flow switches: Flow-proving switches shall be differential pressure type. Switches shall be UL listed, SPDT snap-acting, and pilot duty rated (125 VA minimum). Scale range and differential shall be suitable for intended application and NEMA 1 enclosure unless otherwise specified. Paddle-type flow switches are not acceptable.

N. Low limit air stream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Provide one thermostat for each 25 square foot of coil area. Low limit thermostat shall be manual reset and shall be double pole so as to provide input capability for alarm at the EMS.

O. High limit thermostats shall be located as directed and shall be manual reset type set at 120°F in the return and 180°F in the discharge. Thermostats shall be double pole so as to provide input capability for alarm at the EMS.

P. Humidity Sensors: Wall mount sensors shall have a minimum sensing range of 0%-95%. Duct mount sensors shall have a minimum sensing range of 20%-80%. Duct mount sensors shall have a sampling chamber. Outdoor air humidity sensors shall have a sensing range of 0%-100% RH and shall be suitable for ambient conditions of -40-60deg C (-40-140deg F). Wall and duct mount humidity sensors shall be Vaisala HMD/W60/70 Series Transmitters, or approved equal. Outdoor air mounted humidity sensors shall be Vaisala HMP60 probe with DTR500 shield, or approved equal. Wall mounted sensors shall be mounted at 54 inches AFF unless indicated otherwise on drawings.

N. Air static differential pressure transmitters shall have an overpressure rating of up to 10psi depending on range. The transmitter shall have an accuracy of not less than +/- 1.0% full scale with an operating environment of 0 to 175 deg F. Output shall be a 4 20mA. Transmitters shall be Setra Model 264, or approved equal..

O. Liquid pressure transmitters shall be housed in a NEMA 4 enclosure with a burst pressure rating of 500% rated range and overpressure rating of 300% rated range. The transmitter shall have an accuracy of not less than +/- 1.0% full scale with an operating environment of 0 to 180°F and 10-90% RH Non-Condensing. Output shall be 4-20mA. Transmitters shall be Mamac PR-264, or approved equal.

P. Liquid differential pressure transmitters shall be housed in a NEMA 4 enclosure with a burst pressure rating of 500% rated range, overpressure rating of 300% rated range and maximum static pressure rating of 200% of differential pressure range. The transmitter shall have an accuracy of not less than +/- 1.0% full scale with an operating environment of 0 to 180°F and 10-90% RH Non-Condensing. Output shall be 4-20mA. Transmitters shall be Mamac PR-283, or approved equal.

Q. Steam pressure measurements shall be accurate to +/- 0.13% of range using a solid-state sensing element. The range of the instrument selected shall be 2 times the operating pressure of the sensed variable. Unit shall be provided with isolation and bypass manifold for start-up and maintenance operations. Transmitter shall be Setra model C-207, or approved equal.

R. CO2 Sensors: CO2 sensors shall provide simultaneous analog outputs in volts and milliamps and shall have a gold bifurcated relay that can be operated as normally open or closed; sensor shall incorporate elevation correction adjustment and ABCLogic™ (Automatic Background Calibration) software for self-correction of drift to better than ±10ppm per year. Sensor shall have an accuracy of ±40 ppm or 3% of the reading

(whichever is greater) @ 72°F. All adjustments to the sensor including output scaling, elevation adjustment, relay setpoint, relay dead-band, proportional or exponential output, and single-point calibration shall be made via computer connection to an on-board RJ45 jack. Sensor shall have a detachable base with all field wiring terminals on the base. Sensor shall suitable for wall, duct or outdoor sensing application as required. CO2 sensor shall be the GE Telaire 8001 non-dispersive infrared sensor, or approved equal. Wall mounted sensors shall be mounted at 54 inches AFF unless indicated otherwise on drawings.

S. Control relays shall be plug-in type or encapsulated, UL listed and with coil and contact ratings suitable for the application. Provide NEMA 1 enclosure for relays not installed in local control panel.

T. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

U. Damper blade position limit switch shall be Kele model LS45M91B11 Whisker Switch, or approved equal. Damper actuator switches are not acceptable. Devices which only sense damper shaft position are not acceptable.

V. Door position switch shall be a hermetically sealed reed switch nominally 3" L x 1" H x 0.50" D with matching actuating magnet. Contact and magnets shall be in brushed anodized aluminum tube housing. Contact shall be sealed. Each contact shall connect to three feet of flex stainless steel conduit. Switches shall be GE Sentrol model 2505A, or approved equal.

W. Condensate pan high level alarm switch shall be in inline, low voltage condensate overflow shutoff pre-wired with 4-foot, 18 AWG wires. Switch shall be RectorSeal Safe-T-Switch SS1, or approved equal.

X. Area surface moisture detection system shall be 12V or 24V AC or DC hardwire-powered with up to six surface sensor probes; form C (SPDT) 1 Amp @ 24VAC, 1 Amp @ 30VDC output; 32 to 140°F operating temperature; high humidity or condensation conditions will not cause alarm. System shall be Winland Electronics WaterBug WB-200 with W-S-U surface sensor, or approved equal.

Y. Voltage sensing relays shall be capable of monitoring and reacting to over and under voltage conditions. Adjustable upper and lower voltage trip-points, LED indication of both presence of input voltage and when output is energized and adjustable transfer-of-contacts timing delay. Relay shall be Magnecraft 831VS-120, or approved equal.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate this section's work with work of others. EMS Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.02 PROTECTION

A. EMS Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.

B. EMS Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.03 COORDINATION

A. Site

1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Test and Balance

1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
2. Train Test and Balance Contractor to use control system interface tools.
3. Provide a qualified technician to assist with testing and balancing the first five (5) terminal units.
4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

3.04 INSTALLATION

A. General Notes:

1. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.
2. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.
3. Install specified temperature control equipment in Mechanical Equipment and Machine Rooms, and Penthouse Mechanical Equipment rooms in local control panels. Refer to Article entitled "Local Control Panels".
4. Install and properly support all ductstats, dial thermometers, thermostat bulbs, temperature and humidity sensors and controllers, etc., in the center of duct cross section, in a straight duct run.

5. Provide averaging type elements for sensing mixed air temperatures in ductwork, with sufficient length or sufficient number of elements, so as to efficiently measure the air temperature through the entire cross section of duct.
6. Test all electric and electronic equipment provided under this Section.

B. Provide DDC/electric-electronic control system, as noted on the drawings and as specified. Provide all necessary relays, mounting brackets, gages, switches and accessories required, even though not specifically called for, so as to result in complete workable systems.

C. All work described in this section shall be installed, wired, circuit-tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer or its exclusive factory authorized installing contracting field office (representative). The installing office shall have a minimum of five years of installation experience with the manufacturer and shall provide documentation in submittal package verifying longevity of the installing company's relationship with the manufacturer. Supervision, calibration and checkout of the system shall be by the employees of the local exclusive factory authorized temperature control contracting field office (branch or representative).

D. Install system and materials in accordance with manufacturer□s instructions, and as detailed on the project drawing set.

E. Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the EMS contractor.

F. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.05 WIRING

A. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations.

B. Low voltage and line voltage wiring to actuators is considered control wiring and shall be provided by the EMS contractor unless shown otherwise on electrical drawings.

C. Line voltage wiring to EMS controllers and equipment panels is considered control wiring and shall be provided by the EMS contractor unless shown otherwise on electrical drawings.

D. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.

E. Low-voltage wiring shall meet NEC Class 2 requirements. Sub-fuse low-voltage power circuits as required to meet Class 2 current limit.

F. NEC Class 2 (current-limited) wires not in raceway shall be plenum-rated and UL listed for the intended application.

G. Install wiring in raceway where subject to mechanical damage and at levels below 10ft in mechanical, electrical, or service rooms.

H. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

I. Do not install wiring in raceway containing tubing.

J. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 10 ft intervals.

K. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.

L. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.

M. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.

N. Include one pull string in each raceway 1 in. or larger.

O. Use color-coded conductors throughout.

P. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

Q. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 6 in. between raceway and high-temperature equipment such as steam pipes or flues.

R. Adhere to requirements in Division 26 where raceway crosses building expansion joints.

S. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.

T. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.

U. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 3 ft in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.

V. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

3.06 COMMUNICATION WIRING

A. Communication wiring shall be low-voltage Class 2 wiring.

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

C. Communication wires not in raceway but in concealed and accessible locations such as return air plenums shall be plenum-rated and UL listed for the intended application.

D. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

E. Verify entire network's integrity following cable installation using appropriate tests for each cable.

F. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

G. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.

H. Label communication wiring to indicate origination and destination.

I. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.07 INSTALLATION OF SENSORS

A. Install sensors according to manufacturer's recommendations.

B. Mount sensors rigidly and adequately for operating environment.

C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.

D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 1 ft. of sensing element for each square foot of coil area. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the coil.

G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

H. Install outdoor air temperature sensors on north wall at designated location with sun shield.

I. Differential Air Static Pressure

1. Supply Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
2. Return Duct Static Pressure. Pipe pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.
3. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building sensing the average atmospheric pressure at four points (North, South, East and West). Pipe high-pressure port to a location behind a thermostat cover. Provide all necessary filtering, surge dampeners, atmospheric and room static pressure sensing heads, etc., required for accurate and stable building pressurization control.
4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.
5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
6. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.

J. Low limit thermostats, high limit thermostats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.08 ACTUATORS

A. General. Mount actuators and adapters according to manufacturer's recommendations. Low voltage and line voltage wiring to actuators is considered control wiring and shall be provided by the EMS contractor.

B. Electric and Electronic Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations. Low voltage and line voltage wiring to actuators is considered control wiring and shall be provided by the EMS contractor.

1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten linkage.
3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
4. Provide necessary mounting hardware and linkages for actuator installation.

C. Valve Actuators. Connect actuators to valves with adapters approved by actuator manufacturer. Low voltage and line voltage wiring to actuators is considered control wiring and shall be provided by the EMS contractor.

3.09 IDENTIFICATION OF HARDWARE AND WIRING

A. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 2 in. of termination.

B. Label pneumatic tubing at each end within 2 in. of termination with a descriptive identifier.

C. Permanently label or code each point of field terminal strips to show instrument or item served.

D. Label control panels with minimum ½ in. letters on laminated plastic nameplates.

E. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.

F. Label room sensors related to terminal boxes or valves with nameplates.

G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

H. Label identifiers shall match record documents.

3.10 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of final system acceptance. Control system failures during warranty period shall be adjusted, repaired or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner’s warranty service request.

B. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.

C. Provide updates to operator workstation, web server software, project-specific software, graphic software, database software, and firmware at no charge to the Owner during the warranty period. Do not install updates or upgrades without Owner’s prior authorization.

3.11 WARRANTY ACCESS

A. The Owner shall grant to the EMS contractor reasonable access to the EMS during the warranty period. The owner shall allow the contractor to access the EMS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.12 ACCEPTANCE TESTING

A. Upon completion of the installation, the EMS contractor shall load all system software and start-up the system. The EMS contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

B. The EMS contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when the EMS contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner?s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.13 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner’s property. This includes, but is not limited to:
   1. Graphics
   2. Record drawings
   3. Database
   4. Application programming code
   5. Documentation

3.14 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

3.15 OPERATOR INSTRUCTION AND TRAINING

A. Provide training for a designated staff of the Owner. Training shall be eight (8) hours in duration. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, on-site training, or a combination of training methods.

B. All training shall be video-recorded digitally on CD or DVD media as directed by the Owner. All training media shall be turned over to the Owner at the conclusion of the training sessions.

C. Training shall be tailored to the Owner's existing EMS and specific controlled equipment and systems of this project.

3.16 FIELD QUALITY CONTROL

A. Provide the services of a qualified engineer, in the employ of the control systems manufacturer, for the initial start-up and calibration of control systems, and the instruction of Owner's Personnel.

3.17 SOFTWARE INSTALLATION

A. General: The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.

B. Database Configuration: The Contractor shall provide all labor to configure those portions of the database that are required by the point list and sequence of operation.

C. Color Graphic Slides: Unless otherwise directed by the owner, the Contractor shall provide color graphic displays as depicted in the schematic drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for setpoint changes as required by the owner.

3.18 COMMISSIONING AND SYSTEM STARTUP

A. Point to Point Checkout: Each I/O device (both field mounted and those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the Engineer.

B. Controller Checkout: A field checkout of all controllers shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the Engineer by the completion of the project.

C. System Acceptance Testing:

1. All application software shall be verified and compared against the sequences of operation. Control loops shall be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.
2. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the Engineer.
3. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the Engineer.
4. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that

alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

END OF SECTION 230923

SECTION 230924 - MODIFICATIONS TO DIRECT DIGITAL BUILDING CONTROL SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION OF EXISTING SYSTEM

A. The existing system is a Siemens BMS system.

1.02 MODIFICATIONS TO EXISTING SYSTEM

A. Add new rooftop HVAC units, VRF systems, unit ventilators, and appurtenances.

1.03 SUBMITTALS

A. Preliminary Submittal: Existing system test report.

B. Submittals Package: Submit the shop drawings, product data, and quality control submittals specified below at the same time as a package.

C. Shop Drawings:
1. Composite wiring and/or schematic diagrams of the modifications as proposed to be installed (standard diagrams will not be acceptable).

D. Product Data:
1. Catalog sheets, specifications and installation instructions.
2. Bill of materials.
3. Detailed description of system operation.

E. Quality Control Submittals:
1. Company Field Advisor Data: Include:
   a. Name, business address and telephone number of Company Field Advisor secured for the required services.
   b. Certified statement from the Company listing the qualifications of the Company Field Advisor.
   c. Services and each product for which authorization is given by the Company, listed specifically for this project.

F. Contract Closeout Submittals:
1. System acceptance test report.
2. Certificate: Affidavit, signed by the Company Field Advisor and notarized, certifying that the system meets the contract requirements and is operating properly.
3. Operation and Maintenance Data:
   a. Deliver 2 copies, covering the installed products, to the Owner. Include:
      1) Operation and maintenance data for each product.
      2) Complete point to point wiring diagrams of entire system as installed. Number all conductors and show all

terminations and splices. (Numbers shall correspond to markers installed on each conductor.)

1.04 QUALITY ASSURANCE

A. Company Field Advisor: Secure the services of a Company Field Advisor from the Company of the existing system for a minimum of 24 working hours for the following:
   1. Render advice and witness test of existing system.
   2. Render advice regarding modifications to the system.
   3. Assist in reprogramming of the system.
   4. Witness final system test and then certify with an affidavit that the modifications were installed in accordance with the contract documents and are operating properly.

PART 2 PRODUCTS

2.01 CONTROL COMPONENTS

The following is a list of required devices, refer to the drawings for required quantities and submit components for approval which are compatible with the existing system.

A. Electronic Analog Sensors:

B. Binary Sensors:

C. Pneumatic Sensor/Controllers:

D. Field Panels and Points:

E. Electric Power Control Devices:

F. Damper Motors & Accessories:

G. Valves:

2.02 MARKERS AND NAMEPLATES

A. Markers: Premarked self-adhesive; W.H. Brady Co.'s B940, Thomas and Betts Co.'s E-Z Code WSL self-laminating, Ideal Industries' Mylar/Cloth wire markers, or Markwick Corp.'s permanent wire markers.

B. Nameplates: Precision engrave letters and numbers with uniform margins, character size minimum 3/16 inch high.
   1. Phenolic: Two color laminated engraver's stock, 1/16 inch minimum thickness, machine engraved to expose inner core color (white).
   2. Aluminum: Standard aluminum alloy plate stock, minimum .032 inches thick, engraved areas enamel filled or background enameled with natural aluminum engraved characters.

3. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

2.03 WIRING

A. See Section 260501.

2.04 ACCESSORIES

A. Include accessories required for the modifications to perform the functions specified and indicated on the drawings.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Test of Existing System:
   1. Prior to modifying the system, test portions of the existing system to ascertain their operating condition. Specifically, test:
      a. Active points which will be modified.
      b. Primary operators station (POS) and distributed control processor (DCP) functions associated with the modifications.
   2. Prepare a written report for the Owner indicating the repairs required, if any, to make the existing system function properly.
   3. Repairs to the existing system are not included in the Work unless requested by Order on Contract.

3.02 INTERRUPTIONS TO EXISTING SYSTEM

A. Maintain the existing system in its present condition to the extent possible while installing new Work.

B. Prior to making changes relative to the existing system, notify the Owner and have procedures approved.

3.03 INSTALLATION

A. Install the Work in accordance with the Company's printed instructions unless otherwise indicated.

B. Reprogram the system to include new sensor and control points and update existing system program to include changes and additions requested by facility
   1. Obtain from the facility personnel through the Owner, a list of desired system program changes, additions, etc.

C. Identification, Labeling, Marking:
   1. Identification of Circuits: Identify wires, cables, and tubing by system and function in interconnection cabinets, POSs and DCPs to which they connect with premarked, self-adhesive, wraparound type markers. Designations shall correspond with point to point wiring diagrams.

3.04 FIELD QUALITY CONTROL

A. Preliminary System Test:
   1. Preparation: Have the Company Field Advisor adjust the completed system and then operate it long enough to assure that it is performing properly.
   2. Run a preliminary test for the purpose of:
      a. Determining whether the system is in a suitable condition to conduct an acceptance test.
      b. Checking and adjusting equipment.

B. System Acceptance Test:
   1. Preparation: Notify the Owner at least 3 working days prior to the test so arrangements can be made to have a Facility Representative witness the test.
   2. Make the following tests:
      a. Test system operational functions associated with the modifications.
      b. Test each monitor and control device connected or added under this project.
   3. Supply all equipment necessary for system adjustment and testing.
   4. Submit written report of test results signed by Company Field Advisor and the Owner. Mount a copy of the written report in a plexiglass enclosed frame assembly adjacent to the POS.

END OF SECTION

SECTION 232000 – HVAC PIPING

PART 1 - GENERAL

1.01 SUBMITTALS

A. Product Data: Manufacturer's name and the schedule, type of class of all pipe and fittings.

1. Where optional materials are specified in the "Pipe and Fitting Schedule", provide a pipe schedule to indicate the options selected; including piped systems, pipe material and break down of pipe sizes.

B. Quality Control Submittals

1. Installers Qualification Data
   a. Welder Qualification Data: Copies of certification; including names and previous project experience of welders.
   b. Brazer Qualification Date for Refrigerant Piping: State refrigerant piping brazing experience; including names and list of previous project experience of brazers.

1.02 QUALITY ASSURANCE

A. Qualifications of Welding Procedures, Welders and Welding Operators: Comply with the following:

1. Section IX ASME Boiler and Pressure Vessel Code, Part QW Welding.
2. American Welding Society Standard AWS D10.9, AR-3

B. Qualifications of Brazers: Comply with the following:

1. Section IX ASME Boiler and Pressure Vessel Code, Part QB Brazing.
2. Certification of brazing operator by recognized authorities which require a qualification test.
3. Refrigerant Piping: The persons performing the brazing and their supervisors shall be personally experienced in refrigerant piping brazing procedures.

C. Codes and Standards

1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work and ASME Boiler and Pressure Vessel Code, Section IX, Part QW Welding or in accordance with AWS B2.1 Specifications for Welding Procedure and Performance Qualification.

2. Certify welding of piping work using Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB).

3. Brazing: Certify brazing procedures, brazers, and operations in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Part QB Brazing for shop

and job-site brazing of piping work or in accordance with AWS B2.2 standard for Brazing Procedure and Performance Qualification.

4. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with:
MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69 Pipe Hangers and Supports - Selection and Application
MSS SP-89 Pipe Hangers and Supports - Fabrication and Installation Practices
Piping shall be supported at distances not exceeding the spacing specified in MC Table 305.4 or in accordance with the above MSS standards.

5. Comply with ANSI B31.1A, ASME Code for pressure Piping, and ASHRAE Equipment Guide.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Heating Hot Water Piping

Operating Pressure	125 psig
Operating Temperature	150^{o} - 250^{o}F
Design Code (ANSI)	B31.9

B. Chilled Water Piping

Operating Pressure	125 psig
Operating Temperature	40^{o} - 60^{o}F
Design code (ANSI)	B31.9

C. Condenser Water Piping

Operating Pressure	125 psig
Operating Temperature	80^{o} - 110^{o}F
Design Code (ANSI)	B31.9

D. Dual Temperature Water Piping

Operating Pressure	125 psig
Operating Temperature	40^{o} - 250^{o}F
Design Code (ANSI)	B31.9

E. Refrigerant Piping

Operating Pressure	700 psig
Operating Temperature	40^{o} - 120^{o}F
Design Code (ANSI)	B31.5

PART 2 – PRODUCTS

2.01 STEEL PIPE AND FITTINGS

A. Standard Weight Schedule 40 or Extra Heavy Weight Schedule 80 Pipe, black or

galvanized: ASTM A 53, ASTM A 106 or ASTM A 135.

B. Flanges, Welding Neck Type, Same Pressure Rating as Adjoining Pipe: ASME B16.5.

C. Welding Fittings, Carbon Steel:

1. Butt Welding Type: ASME B16.9
   a. Allied Piping Products Co., Inc.'s Branchlets, Type 1 or 2
   b. Bonney Forge Corp's Weldolets
2. Socket Welding Type: ASME B16.11
   a. Allied Piping Products Co., Inc.'s Branchlets, Type 1 or 2
   b. Bonney Forge Corp's Threadolets or Sockolets

D. Compact Design Weld Fittings: Landish Co.'s LP, Nibco Inc's Husky, Taylor Forge Inc.'s Compact Line, Tube Turns Inc.'s Econo.

E. Malleable Iron, Steam Pattern Threaded Fittings

1. 150 lb. Class: ASME B16.3
2. 300 lb. Class: ASME B16.3

F. Cast Iron Fittings

1. Drainage Pattern, Threaded: ASME B16.12
2. Steam Pattern, Threaded: ASME B16.4
   a. Standard Weight: Class 125
   b. Extra Heavy Weight: Class 250
3. Flanged Fittings and Threaded Flanges: ASME B16.1
   a. Standard Weight: Class 125
   b. Extra Heavy Weight: Class 250

G. Unions: Rated 250 psi at 210 degrees F; ASME B16.39

H. Unions: Rated 250 psi at 275 degrees F; ASME B16.39

I. Couplings: Same material and pressure rating as adjoining pipe, conforming to standards for fittings in such pipe. Use taper tapped threaded type in screwed pipe systems operating in excess of 15 psig.

J. Nipples: Same material and strength as adjoining pipe, except nipples having a length of less than one inch between threads shall be extra heavy.

2.02 COPPER AND BRASS PIPE, TUBING AND FITTINGS

A. Water Tube, Types K, L, and M: ASTM B 88

B. Wrot Copper Water Tube Fittings, Solder Joint: ASME B16.22

C. Refrigerant Tube, Dry Sealed, Soft Annealed: ASTM B 280

D. Flared Tube Fittings:

1. Water Tube Type: ASME B16.26
2. Automotive Tube Type: SAE J512
3. Refrigerant Tube Type: SAE J513

E. Flanges: Conform to the Standards for fittings used in systems.

1. Brazing Flanges: ASME B16.24, hubs modified for brazing ends.

F. Unions: Cast bronze, 150 lb. Class, bronze-to-bronze seats, threaded or solder joint.

G. Cast bronze threaded fittings, Class 125 working steam pressure, conforming to ASTM B62 and ASME B16.24.

H. Hydronic press fittings (press fit - pressure-sealed joints) by Viega ProPress, Elkhart Xpress, NIBCO Press System, Grinnell G-Press (or approved equal) up to and including 4" in diameter. O-rings: EPDM; Special Tools recommended and approved by the Manufacturer. Press fittings are not acceptable for refrigerant piping.

I. Mechanically formed tee-branch outlets may be used on aboveground copper tubing. The mechanically formed outlet shall be by T-Drill Industries, Inc. or approved equal. All joints formed in this manner shall be brazed in compliance with manufacturer's recommendations. Soft soldered joints shall not be permitted.

2.03 JOINING AND SEALANT MATERIALS

A. Thread Sealant

1. Lake Chemical Co.'s, Slic-Tite.
2. Loctite Corp's pipe sealant with Teflon.

B. Solder: Solid wire type conforming to the following:

1. Lead-free tin-Silver solder (ASTM B 32 Alloy Grade Sn 96): All-State Welding Products Inc.'s 430, J. W. Harris Co. Inc's Stay-Brite or Engelhard Corp's Silvabrite.

C. Soldering Flux for Soldered Joints

1. Solder: All-State Welding Products Inc.'s Duzall; J. W. Harris Co. Inc.'s Stay-Clean; Engelhard Corp's General Purpose Liquid or Paste.

D. Brazing Alloys

1. AWS A5.8, Class BCuP-5, for brazing copper to brass, bronze, or copper; Englehard's Silvaloy 15; J. W. Harris Co.Inc.'s Stay-Silv 56; and Handy & Harman's Braze 560.
2. AWS A5.8, Class BAg-7, for brazing copper to steel or stainless steel; Englehard's Silvaloy 56-T; J. W. Harris Co.Inc.'s Safety-Silv 56; and Handy & Harman's Braze 560.

E. Brazing Flux: FS O-F-499, Type B; Handy & Harman's Handy Flux or J. W. Harris Co. Inc.'s Stay-Silv.

F. Electrodes and Welding Rods

1. Electrodes for use in Arc Welding: Heavily coated, not larger then 3/16 inch diameter exclusive of coating, unless otherwise acceptable.
2. Welding Rods: Free flowing when fused, so as to avoid excessive puddling.
3. Electrodes for Welding Stainless Steels: Coated and used with reverse polarity
4. Filler material shall conform to the appropriate AWS-ASTM specification.

G. Flange Gasket Material

1. For Use with Cold Water or Chilled Water: 1/16 inch thick rubber and chemical compatibility with the system fluid.
2. For Use with Hot Water, Air or Steam: Waterproofed non-asbestos mineral or ceramic fiber, or a combination of metal and waterproofed non-asbestos mineral or ceramic fiber, designed for the temperature and pressures of the piping systems in which installed and chemical compatibility with the system fluid.

H. Anti-Seize Lubricant: Bostick Inc.'s Never Seez or Dow Corning Corp's Molykote 1000.

2.04 GROOVED PIPING SYSTEM

A. Grooved piping system as manufactured by Victaulic Co., Grinnell by Tyco, Gruvlok by ANVIL or acceptable manufacturer.

B. Pipe:

1. Standard Weight Schedule 40 or Extra Heavy Weight Schedule 80 Pipe, black or galvanized: ASTM A 53, ASTM A 106 or ASTM A 135.
2. Use roll grooved pipe, cut grooved end piping is not acceptable.
3. Couplings: Victaulic Co.'s flexible type Style 77 and W77,-having pressure rating of:
   a. 1000 psi for 3/4 inch to 6 inch
   b. 800 psi for 8 inch to 12 inch
   c. 350 psi for 14 inch to 24 inch

C. Couplings and Fittings for Grooved End Pipe

1. Grooved-End-Tube Couplings: Rigid pattern gasketed fitting. Ductile-iron housing cast with offsetting, angle-pattern bolt pads to provide visual confirmation of joint integrity upon metal-to-metal pad contact. Tongue and recess rigid type couplings may only be used if the contractor uses a torque wrench for installation. Required torque shall be in accordance with the manufacturer's latest recommendations and each coupling shall be tagged indicating the specific value of torque attained to confirm joint rigidity and proper installation. Synthetic EPDM gasket similar to Grade EHP rated for maximum 250 deg F or Grade E EPDM rated to maximum of 230 deg F for use with housing, and steel bolts and nuts. Couplings shall be manufactured to connect copper tubing sized tube and fittings.

2. Couplings: Victaulic co.'s Zero-Flex Style 07 and 107H, having minimum pressure rating of:

a. Style 107H or Style 07
   1) 750psi from 2 inch to 5 inch
   2) 700psi for 6 inch
   3) 600psi for 8 inch
   4) 500psi for 10 inch (07 only)
   5) 400psi for 12 inch (07 only)
c. Style W07: 350 psi.

1. Fittings: By same manufacturer as couplings, having pressure ratings equal to or greater than couplings. Comply with the following standards:
   a. Steel: ASTM A53 or A106, Grade B
   b. Wrought Steel: ASTM A234, Grade WPB
   c. Ductile Iron: ASTM A536
2. Gaskets for Use with Grooved End Pipe and Fittings: Type and materials as recommended and furnished by the fitting manufacturer, for the service of piping system in which installed.
3. Flange Adapter: Flat face, ductile iron housings with elastomeric pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741/W741.
4. Pipe Joint Make-up:
   a. Grooved Pipe Joint. Make up joint with grooved end fittings and couplings, in conformance with the manufacturer's printed installation instructions. Pipe grooving shall be rolled in accordance with joint manufacturer's specifications. Lubricate gasket exterior including lips, pipe ends and housing interiors to prevent pinching the gasket during installation. Lubricant shall be as recommended by coupling manufacturer.

2.05 PACKING MATERIALS FOR BUILDING CONSTRUCTION PENETRATIONS

A. Oakum: FA A-A-1186

B. Mechanical Modular Seals: Thunderline Corp's Link Seal wall and floor seals designed for the service of piping system in which installed.

2.06 DIELECTRIC CONNECTORS

A. Brass nipples, couplings, fittings, valves or combinations of are not considered a dielectric connection and shall not be an acceptable assembly for such.

B. Dielectric waterway fittings with an inert, non-corrosive thermoplastic lining (NSF/FDA listed). Manufacturer: Grinnell, GruvLok or Victaulic Co.

C. Flange Electrical Insulation Kit: Consisting of dielectric sleeves and washers and dielectric gasket.

1. Rated 250 psi at 210 degrees F.
2. Rated 250 psi at 275 degrees F.

D. Flange Unions: Rated 175 psi at 210 degrees F; ASTM B16.42 (iron) and ASTM B16.24 (bronze).

2.07 PIPE SLEEVES

A. Type A: Schedule 40 steel pipe.

B. Type B: No. 16 gauge galvanized sheet steel.

C. Type C: Schedule 40 steel pipe and 1/4 inch steel collar continuously welded to pipe sleeve. Size steel collard as required to span a minimum of one cell or corrugation, on all sided of the rough opening thru the metal deck.

D. Type D: No. 16 gauge galvanized sheet steel with 16 gauge sheet steel metal collar rigidly secured to sleeve. Size metal collard as required to span a minimum of one cell or corrugation on all sides of the rough opening thru the metal deck.

2.08 FLOOR, WALL AND CEILING PLATES

A. Cast Brass: Polished chrome plated finish, with set screw.

1. Solid Type: Models 5 and 5T by Pegasus Manufacturing Inc., Cheshire, CT; and Models 951 – 960 (inclusive) by Bridgeport Plumbing Products, Moultrie, GA.
2. Split Type: Models 3 and 3T by Pegasus Manufacturing Inc., Cheshire, CT.

B. Cast Iron: Solid type, unplated, with set screw. Model 395 by Grinnell Corp., Cranston, RI.

2.09 DRIP PANS

A. Fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up $2^1/_2$". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.

PART 3 - EXECUTION

3.01 INSTALLATION – GENERAL

A. The drawings show the general arrangement of pipe equipment but do not show all required fittings and offsets that may be required. Provide all necessary fittings, offsets and pipe runs based on field measurements.

B. Provide dielectric connections whenever connecting dissimilar materials

C. Install vertical piping plumb and piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide one inch minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope steam, condensate and drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

D. Install piping clear of door swings and above sash heads.

E. Make allowances for expansion and contraction.

F. Use fittings for offsets and direction changes, except for Type K soft temper water tube.

G. Cut pipe and tubing ends square: ream before joining.

H. Threading: Use American Standard taper pipe thread dies.

1. Thread brass pipe with special brass threading dies.

I. Make final connections to equipment with unions, flanges, or mechanical type joint couplings.

J. Provide taps and install wells in piping for EMS/control system sensors and flow measurement devices.

K. Install pipes in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Align piping accurately at connections, within 1/16" misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.

L. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations. Run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. All piping in finished and occupied spaces shall be concealed from view by locating piping in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated on the Drawings.

M. Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures. Install drip pan under piping that must be run above electrical equipment. Do not run piping in stairwells or elevator equipment rooms except for systems serving those spaces.

N. In the outlet from each cooling coil condensate drain pan, provide a tee with a brass plug at one end to facilitate cleaning of drain. Additionally, provide a single "P" trap for proper operation of the unit.

O. Riser Casings: Unless otherwise indicated on the drawings, all exposed risers, including the drop risers, shall be enclosed in casings extending from floor to a height of 7'-6" above floor. Riser casings shall be installed after the pipe insulation work is completed, inspected and approved. Casings shall be made of 24-gage galvanized sheet steel, with the upper end wired with 1/8" half hard wire. Each casing shall be fastened to the wall at the upper end with a metal band and round head screws. Seams shall be located at the rear of the casing.

P. Casing for pipe at or near floors: Where pipes at or near floors are indicated on the Drawings to be encased, pipes shall be supported, insulated, and then enclosed in a casing of No. 20-gage galvanized sheet steel.

Q. Protection of Refrigerant Piping Located Inside Buildings: Refrigerant piping and fittings installed at a height less than 7'-3" above the floor shall be concealed or otherwise protected from mechanical damage except at the point of connection to terminal equipment.

R. Refrigerant piping that crosses an open space that affords passageway in any building shall be not less than 7'-3" above the floor unless the piping is located against the ceiling of such space. Refrigerant piping shall not be placed in any elevator, dumbwaiter or other shaft containing a moving object or in any shaft that has openings to means of egress. Refrigerant piping shall not be installed in an enclosed public stairway, stair landing or an exit.

S. Refrigerant piping shall not be installed in public corridors unless it complies with all of the following conditions:

1. The refrigeration system to which the piping is associated utilizes a Group A-1 refrigerant and contains not more than 10 pounds of refrigerant per system, and there is not more than one system's refrigerant piping per tenant per public corridor; and

2. A complete discharge of any one refrigerant system's charge into the volume of the public corridor would be insufficient to achieve 50% of the allowable refrigerant RCL set forth in ASHRAE Standard 34; and

3. Refrigerant piping and fittings within a public corridor are installed with brazed joints or the refrigerant equipment manufacturer provided pre-charged tubing systems installed in accordance with the refrigerant equipment manufacturers instructions. Refrigerant piping and fittings shall be concealed or otherwise protected from mechanical damage.

T. Refrigerant piping shall not penetrate floors, ceilings or roofs except the following:

1. Penetrations connecting the basement and the first floor

2. Penetrations connecting the top floor and a machinery penthouse or roof installation

3. Penetrations connecting adjacent floors served by the refrigeration system.

4. Penetrations by piping in a direct system where the refrigerant quantity does not exceed the RCL set forth in ASHRAE Standard 34 for the smallest occupied space through which the piping passes.

5. Penetrations by piping enclosed by gas-tight, fire resistive duct or shaft as shown on the Drawings.

U. For steel piping runouts not detailed on the Drawings, use three elbow connections between runouts and mains.

V. Connections to Equipment: provide three elbow runouts to all rotating equipment such as pumps and chillers. Provide swing connections for boilers. Provide two elbow connections to fuel oil tanks.

W. Connections to Building Structure: connect to trusses and joints at panel points. Provide supplementary steel framing at panel points to transfer loads to framing.

X. Connection to domestic water system shall be protected by reduced pressure principal backflow preventer.

Y. Condensate drain piping from cooling coil drain pans shall be pitched at not less than one-eighth unit vertical in 12 units horizontal (1-percent slope) in the direction of discharge.

3.02 WATER AND GLYCOL PIPING SYSTEMS

A. Pitch

1. Pitch horizontal piping 1/8 inch per 10 ft. in direction indicated on drawings. When direction of flow is not indicated, pitch supply piping up in direction of flow and return piping downward indirection of flow.
2. Pitch single pipe systems up in direction of flow 1/8 inch per 10 ft.

B. Air Vents: Install air vents at locations indicated on the drawings and at each high point in system. Use manually operated air vents, unless otherwise indicated.

C. Drains

1. Install piping to be completely drainable. Provide drains at low points, consisting of a 1/2 inch Drain Valve (Apollo #78-200) and at the following locations and equipment:
   a. In each section of piping separated by valves.
   b. For each riser, where riser or runout to riser has a valve installed.
   c. For each heating cooling unit, having valves in supply and return connections.
   d. In low point of piping to each down fed convector or radiator.

D. Runouts: Connect runouts to upfeed risers to top of mains and runouts to downfeed riser to bottom of mains.

3.03 PIPE JOINT MAKE-UP

A. Threaded: Threads shall conform to ASME B1.20, joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead point for corrosion protection.

B. Soldered: Thoroughly clean tube end and inside of fitting with sandpaper or wire brush. Apply flux to the pre-cleaned surfaces. Install fitting, heat to soldering temperature, and join the metals with type solder specified. Remove residue.

C. Flange:

1. Install threaded companion flanges on steel pipe; flanges on galvanized pipe are not required to be galvanized.
2. Provide a gasket for each joint.
   a. Hot Water Pipe Gasket: Coat with a thin film of oil before making up joint.
   b. Compressed, Control, and Instrument Air Pipe Gasket: Coat with a thin film of oil before making up joint.
3. Coat bolt threads and nuts with anti-seize lubricant before making up joint

D. Welded: Beveling, spacing and other details shall conform to ASME B31.9. See Welder's qualification requirements under "Quality Control Submittals" in Section 1.03, Submittals.

E. Welded: Beveling, spacing and other details shall conform to ASME B31.1. See Welder's qualification requirements under "Quality Control Submittals" in Section 1.03, Submittals.

F. Compact design weld fittings up to and including 12 inch in size may be used in low pressure steam and heating hot water piping systems.

G. Brazed Joint: Thoroughly clean tube end and inside of fitting with sandpaper or wire brush. Apply flux to the pre-cleaned surfaces. Install fitting, heat to brazing temperature, and join the metals with brazing alloy. Remove residue.

H. The use of mechanical formed outlets on copper tubing instead of soldered joints is acceptable. The maximum diameter of branches shall be $2^{1}/_{8}$". Use appropriate tool designed for mechanical formed outlets on copper tubes. All mechanical formed tee fittings shall be brazed in accordance with the Copper Development Associations Copper Tube Handbook Using BCuP series filler metal. All mechanical formed branch collars shall be listed by UPC, and Underwriters Laboratory. They shall comply with ASME Code for pressure piping ANSI B31.5c.

I. Press-Fit (Pressure Seal) Fittings: Connections shall be made in accordance with the manufacturer's installation instructions. Copper tubing shall be cut at right angles using displacement type cutter or fine-toothed saw. Burrs shall be removed from inside and outside of tubing to prevent cutting sealing element. Mark insertion depth according to manufacturer's insertion depth chart. Seals and grip ring shall be checked for correct fit. Only the manufacturer's sealing elements shall be used. Press fitting shall be slid onto tubing while turning slightly to the marked depth. Oils or lubricants shall not be used. Fitting connections shall be made with the tool provided by manufacturer. The manufacturer's assembly tool shall be used to perform the pressing process. For locations where there is insufficient access to accommodate the pressing tool, this type of joint is not allowed. Sufficient clearance must be left around each joint to allow room for the pressing tool and jaw to be attached without interference when repairing the system in the future.

J. Dissimilar Pipe Joints

1. Joining Dissimilar Threaded Piping: Make up connection with a threaded coupling or with companion flanges.
2. Joining Dissimilar Non-threaded Piping: Make up connection with adapters

recommended by the manufacturers of the piping to be joined.

3. Joining Steel pipe, Brass or Copper Tubing: Make up joint with a dielectric connector.

3.04 PIPING PENETRATIONS

A. Sleeve Schedule: Unless otherwise shown, comply with the following schedule for the type of sleeve to be used where piping penetrates wall, floor, or roof construction.

	CONSTRUCTION	SLEEVE TYPE
1.	Frame construction	None Required
2.	Foundation walls	A*
3.	Non-waterproof interior walls	B*
4.	Non-waterproof interior floors on metal decks	D*
5.	Non-waterproof interior floors not on metal decks	B*
6.	Floors not on grade having a floor drain	A*
7.	Floors over mechanical equipment, steam service, machine and boiler rooms.	A
8.	Floors finished or to be finished with latex composition or terrazzo, and on metal decks.	D*
9.	Floors finished or to be finished with latex composition or terrazzo and not on metal decks.	A
10.	Earth supported concrete floors	None Required
11.	Exterior concrete slabs on grade	A
12.	Fixtures with floor outlet waste piping	None Required
13.	Metal roof decks	C
14.	Mon-metal roof decks	A
15.	Waterproof floor on metal decks	D
16.	Waterproof floors not on metal decks	A
17.	Waterproof walls	A

* - core drilling is permissible in lieu of sleeves where marked with asterisks.

B. Diameter of Sleeves and Core Drilled Holes

1. Unless otherwise specified, size holes thru floors and walls in accordance with the through penetration fire stopping system being used.
2. Size holes thru exterior masonry walls or waterproofed walls above inside earth or finished floors, and exterior concrete slabs in accordance with the following:
   b. Un-insulated (Bare) Pipe: Inside diameter of sleeve or core drilled hole 1/2 inch greater than outside diameter of pipe, unless otherwise specified.
   c. Insulated Pipe: Inside diameter of sleeve or core drilled hole 1/2 inch greater than outside diameter of insulation, unless otherwise specified.
   d. Mechanical Modular Seals: Size holes in accordance with the manufacturer's recommendations.

C. Length of Sleeves (except as shown otherwise on Drawings)

1. Walls and Partitions: Equal in length to total finished thickness of wall or partition.
2. Floors, Finished: Equal in length to total finished thickness of floor and

extending 1/2 inch above the finished floor level, except as follows:

a. In furred spaces at exterior walls, extend sleeve one inch above the finished floor level.

3. Exterior Concrete Slabs: Equal in length to total thickness of slab and extending 1/2 inch above the concrete slab.
4. Roofs: Equal in length to the total thickness of roof construction, including insulation and roofing materials, and extending one inch above the finished roof level.

D. Packing of Sleeves and Core Drilled Holes

1. Use through-penetration firestop devices, forming materials, and fill, void or cavity materials to form through-penetration firestops to prevent the passage of flame, smoke, fumes, and hot gasses as detailed in the UL Fire Resistance Directory, Warnock Hersey Certification Listings Book, or the Omega Point Laboratories Listings Directory. Where applicable design is not detailed in the Directories use forming materials and fill, void or cavity material to form appropriate through-penetration firestop in accordance with printed details and installation instructions from the Company producing the acceptable forming materials and fill, void or cavity materials.
2. Firestop through-penetration of floors, walls, partitions, ceilings, and roof in accordance with the fire resistance rating assigned to the walls, partitions, floors, ceilings, and roofs on the Construction Work Drawings.
3. Pack sleeves in exterior masonry walls or waterproofed walls above inside earth or finished floors with oakum to within 1/2 inch of each wall face, and finish both sides with one-part, non-sag polysulfide base sealant: Pecora's Synthacalk GC-9, Products Research and Chemicals PRC Rubber Calk 7000, or Sonneborn's One Part Polysulfide Sealant. Optional use of Mechanical Modular Seals is recommended.

E. Weld metal collars of sleeves to the upper surface of the metal deck. Seal voids under the metal collar as recommended by the manufacturer of the metal deck.

3.05 FLOOR, WALL AND CEILING PLATES

A. Install plates for exposed un-insulated piping passing thru floors, walls, and exterior concrete slabs as follows:

1. In Finished Spaces
   a. Piping 4 Inch Size and Smaller: Solid or split, chrome plated cast brass.
   b. Piping over 4 Inch Size: Split, chrome plated cast brass.
2. Unfinished Spaces (including exterior concrete slabs): Solid, unplated cast iron.
3. Fasten plates with set screws.
4. Plates are not required in pipe shafts or furred spaces.

3.06 DRIP PANS

A. Provide drip pans under piping passing over or within 3 feet of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to side of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to the drain connection and run to a conspicuous location 6" above the floor, the nearest plumbing drain, or elsewhere as indicated on drawings.

3.07 CLEANING, FLUSHING, AND INSPECTING

A. Clean exterior surfaces of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items. Inspect pressure piping in accordance with procedures of ASME B31.

B. Upon completion of the installation, remove all protecting materials, all scale and grease and leave in a clean condition for painting.

C. Hanger Adjustments: adjust hangers so as to distribute loads equally on attachments.

D. Support Adjustment: provide grout under supports so as to bring piping and equipment to proper level and elevation.

3.08 PIPING AND FITTING SCHEDULE

A. Abbreviations: The following abbreviations are applicable to the Pipe and Fitting Schedule.

BS – black steel
CI – cast iron
GE – grooved end
GMI – galvanized malleable iron
GS – galvanized steel
MI – malleable iron
SE – screwed end
ST – steel
SW – standard weight
WE – weld weight
XH – extra heavy weight

B. Where options are given, choose only one option for each piping service. Deviations from selected option will be allowed if reviewed with Engineer prior to installation.

C. Schedule of Pipe and Fittings for the different piping services is as follows:

1. Chilled Water (CWS & CWR) 125 psig and less:
   a. 3 inch and less: SW BS pipe with SE & SW CI fittings, or Type L hard temper copper tubing with wrot copper solder fittings or press-fittings.
   b. 4 inch and up: SW BS pipe, with SE & SW CI fittings, or WE & SW ST fittings, or GE & GE fittings.
2. Hot Water Supply and Return (HWS & HWR) 125 psig and less:
   a. 3 inch and less: SW BS pipe with SE & SW CI fittings, or Type L hard temper copper tubing with wrot copper solder fittings and solder or press fittings.
   b. 4 inch size: SW BS pipe, with SE & SW CI fittings, or WE & SW ST fittings, or GE & GE fittings.
   c. 5 inch and up: SW BS pipe, with WE & SW ST fittings or GE & GE fittings.
3. Refrigerants (RS, RL, HG & RD) 500 psig and less: Refrigerant lines shall be ACR tube per ASTM B280. Joints in refrigerant piping shall be brazed. Flared

compression fittings may be used only at the terminal equipment connections for A1 refrigerants only. Soldered joints and mechanical press fittings for refrigerant lines are not permitted.

4. Condensate Drain Piping: Type M hard temper copper tubing with wrot copper solder fittings, and solder or type L hard temper copper tubing with press fittings.

END OF SECTION 232000

SECTION 232001 - STRAINERS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions for each type strainer.

PART 2 - PRODUCTS

2.01 STRAINERS

A. Body:

1. Type: Y-type

2. Material: ASTM A 126 Grade B cast iron, or ASTM A 216 WCB cast steel. ASTM B 62 cast bronze may be used in systems operating at a maximum of 125 psig steam or 175 psig water.

B. Pressure Ratings: 125 psig WSP, 175 psig OWG, when installed in systems operating at pressures up to 125 psig steam or 175 psig water, and 250 psig WSP and 400 psig OWG when installed in systems operating at pressures over 125 psig steam or 175 psig water.

C. End Connections: Screwed ends for use in threaded piping 3 inches in size and smaller; flanged ends in piping 4 inches and larger; and solder ends or screwed ends with solder adapters in Types K, L and M copper tubing.

D. Screens: Fabricate from 18-8 stainless steel or monel metal. For use in steam piping through 6 inch pipe size, 1/32 inch perforations and over 6 inch size, 3/64 inch perforations. For use in closed water and condensate return piping, 1/16 inch perforations through 3 inch size, and 1/8 inch perforations over 3 inch size. In open systems such as cooling tower piping systems, 1/8 inch perforations. Minimum free screen area, double the internal cross sectional area of the inlet pipe. Rigidly reinforce strainer screens, in sizes 14 inches and larger, with stainless steel channels and cross braces.

E. Caps and Covers: Faced and gasketed screen retaining cap, or a straight thread bushing with a blow-out proof gasket, or an internally milled tapered gasketed bushing, for strainers 3 inches in size and smaller. Strainers 4 inch in size and larger shall have a bolted gasketed screen cover. Provide graphited non-asbestos mineral or ceramic fiber gaskets.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide strainers in steam piping 2 inches in size and larger with a blow-off valve full size of blow-off outlet. In water piping 1-1/2 inch and larger, provide a drain valve with hose bibb connection. Install a short nipple and pipe cap in the blow-off outlets of

strainers not specified to have a blow-off valve or drain valve.

B. Install strainers indicated or specified to be installed in the suction or discharge piping connections to pumps in the horizontal piping run as close to pump as possible.

C. Provide strainers in piping immediately upstream of the following equipment and elsewhere as indicated:
1. Pumps.
2. Steam traps serving main steam drips.
3. Temperature control valves.
4. Pressure reducing valves.
5. Temperature and pressure regulating valves.

END OF SECTION 232001

SECTION 232003 - THERMOMETERS AND GAUGES

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications and installation instructions for each item specified.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Where Federal, NSF, ASME or other standards are indicated or required, products shall meet or exceed the standards established for material, quality, manufacture and performance.

PART 2 PRODUCTS

2.01 MANUFACTURERS/COMPANIES

A. Dresser Instruments.

B. Marsh Bellofram.

C. Moeller Instrument Co.

D. Taylor Precision Products.

E. H.O. Trerice Co.

F. Weksler Instruments Corp.

2.02 THERMOMETERS

A. General Design Features:
   1. Scale Ranges: 1-1/2 times actual working temperature required for the particular application, as approved.
      a. Maximum of two degrees between graduations and ten degrees between numerals.
      b. When scale ranges are in excess of 100 degrees, maximum range between numerals may be 20 degrees, or as otherwise approved for the particular application.
   2. Direct Reading Thermometers: Bimetallic actuated, dial type, straight pattern, angle pattern, or adjustable angle pattern as required.
   3. Remote Reading Thermometers: Vapor tension actuated, or gas actuated type, with extension capillary tube of length as required for the particular application.
      a. Case type as required for the particular mounting application.
   4. Thermometers for Sensing Liquid Temperature: Furnish with separable sockets.
      a. Sockets for Use in Insulated Piping, Insulated Tanks or Similar Equipment: Extension lagging neck type, of length as required to compensate for insulation thickness, and proper immersion.

2.03 THERMOMETERS FOR MEASURING LIQUID TEMPERATURE

A. Bimetallic Actuated Thermometers: Comply with ASME B40.3, Accuracy Grade A.
   1. Construction: Type 304 stainless steel, all welded construction, with clear acrylic plastic or shatterproof glass crystal.
   2. Dial: White enamel background with bold black figures and graduations.
   3. Head Size:
      a. Installation in Piping: 3inch diameter.
      b. Installation in Tanks and Similar Equipment: 5 inch diameter.
   3. Stem: Length as required for proper immersion, and to compensate for insulation thickness, with threaded connection for socket.
   4. External Calibration Device.
   5. Separable Socket:
      a. Water Service: Brass or bronze.
      b. Steam Service: Stainless steel.

B. Vapor Tension or Gas Actuated Capillary Thermometers: Adjustable type, with micrometer type pointer or external calibration device, of design and materials as follows:
   1. Case and Ring: Stainless steel or non-ferrous material as approved, with clear acrylic or shatterproof glass lens. Provide case of type as required for the particular mounting application. Case adjustable, allowing rotation of 360°, and stem adjustment of at least 180°. Provide set screw for locking case in desired position.
   2. Movement: Brass with bronze bearings.
   3. Dial: White enamel background, with bold black graduations, numerals and pointer; 3-1/2 inch diameter.
   4. Capillary: Stainless steel.
   5. Bulb: Copper with union well connection.
   6. Separable Socket:
      a. Water Service: Brass or bronze.
      b. Steam Service: Stainless steel.

2.04 THERMOMETERS FOR MEASURING AIR TEMPERATURE

A. Bimetallic Actuated Thermometers: Comply with ASME B40.3, Accuracy Grade A.
   1. Construction: Type 304 stainless steel, all welded construction, with clear acrylic plastic or shatterproof glass crystal.
   2. Dial: White enamel background with bold black figures and graduations.
   3. Head Size: 5 inch diameter.
   4. Stem: Length as required for average duct cross sectional sensing of air temperature, and to compensate for insulation thickness.
   5. External calibration device.

B. Vapor Tension or Gas Actuated Capillary Thermometers: Adjustable 3-1/2inch dial type, with micrometer type pointer or external calibration device, of design and materials as follows:
   1. Case and Ring: Stainless steel or non-ferrous material as approved, with clear acrylic or shatterproof glass lens. Case adjustable allowing rotation of 360°, and stem adjustment of at least 180°. Provide set screw for locking case in desired position.
   2. Movement: Brass with bronze bearings.

3. Dial: White enamel background, with bold black graduations, numerals and pointer; 3-1/2 inch diameter.
4. Capillary: Stainless steel.
5. Bulb: Copper air sensing bulb with split flange mounting device.

2.05 PRESSURE AND COMPOUND GAUGES

A. Type: Adjustable dial type with micrometer type pointer, or external calibration device, bronze bourdon tube, and bronze bushed rotary movement.

B. Dial: White enameled background, and bold black graduations, numerals and pointer; 3-1/2 inch diameter.
1. Scale Range:
a. Standard Gauges: Double normal operating pressure.
b. Compound Gauges: From 30" Hg vacuum to double normal operating pressure.

C. Case: Cast aluminum, brass, or black finished phenolic.

D. Accuracy: Guaranteed of within 1 percent in middle third of dial range.

2.06 PRESSURE SNUBBERS AND IMPULSE DAMPERS

A. Pressure Snubbers: H.O. Trerice Co. Model 872.
B. Impulse Dampers: H.O. Trerice Co. Model 870.

PART 3 EXECUTION

3.01 INSTALLATION

A. Thermometers:
1. Install in accordance with the manufacturer's printed installation instructions.
2. Install direct reading thermometers, when the application requires installation 6 feet or less above the floor or bottom of space in which installed, and remote reading type when the installation is over 6 feet.

B. Pressure and Vacuum Gauges:
1. Install in accordance with the manufacturer's printed installation instructions.
2. For Measuring Steam Pressure: Install gauges complete with needle valves, drain cocks and syphons.
3. For Measuring Liquid Pressure: Install gauges complete with stop cocks and drain cocks.

C. Pressure Snubbers and Impulse Dampers:
1. Install pressure snubbers in the piping connections to gauges installed in suction and discharge piping connections to close coupled and base mounted circulating pumps driven by motors under 10 HP.

2. Install impulse dampers in the piping connections to gauges installed in suction and discharge piping connections to close coupled and base mounted circulating pumps driven by motors 10 HP and over.

END OF SECTION

SECTION 232006 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Catalog sheets, specifications, and installation instructions for each item specified.

B. Contract Closeout Submittals:

1. Operation and Maintenance Data: Submit 2 copies to the Engineer incorporated within maintenance manuals, covering the installed products.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTUERS

Taco
Bell & Gossett
Aurora Pumps

2.02 EXPANSION TANKS

A. Type B Expansion Tank: Pre-pressurized, welded steel (ASME Boiler and Pressure Vessel Code Section VIII, Division I) with heavy duty butyl rubber bladder or diaphragm, air charging valve, and drain valve.

1. Maximum Working Pressure: 125 psig.
2. Maximum Operating Temperature: 240 degrees F.

2.03 COMBINATION AIR SEPARATOR AND SYSTEM STRAINER

A. Type: Welded steel (ASME Boiler and Pressure Vessel Code Section VIII, Division I) with the following features:

1. Internal stainless steel strainer with 3/16 inch perforations and free area greater than 5 times the cross sectional area of the connecting pipe.
2. Bolted and gasketed removable cover plate.
3. Blowdown connection with ball valve.

B. Maximum Working Pressure: 125 psig.

C. Maximum Operating Temperature: 375 degrees F.

2.04 CHEMICAL BY-PASS FEEDER

A. By-Pass Feeder/Filter: Combined chemical addition and filtering, capacity of two gallons, complete with an opening in the top to facilitate charging with chemical, and a screen to properly distribute flow through feeder. Constructed of carbon steel, floor

support legs, ¼ turn positive seal quick release cap, for a working pressure of 200 psi, provide 12 filter changes (min. 20 micron). Approved Manufacturers: JL Wingert Co, Neptune Chemical or Cannon.

2.05 CENTRIFUGAL SEPARATOR

A. Separator: Constructed of carbon steel with no moving parts or filter media, 125 psi maximum pressure rating, and capable of removing solids 74 microns/200 mesh in size and larger; Lakos Separators, Fresno, CA.

1. Automatic Purge Controller: Solid state single channel controller mounted in weather resistant metal enclosure with hasp style closure, and adjustable purging duration from 8 seconds to 30 minutes.
2. Motorized Ball Valve: Lakos Series LR-MBV.

2.06 COALESCING AIR AND SEDIMENT SEPARATOR

A. The separator shall be designed, constructed, and stamped in accordance with Section VIII, Division I of the ASME Boiler and Pressure Vessel Code, and registered with the National Board of Boiler and Pressure Vessel Inspectors.

B. The separator shall be rated for 150 psi maximum working pressure and a maximum temperature rating of 450°F.

C. The body shall be made of carbon steel, shall be at least two times the nominal inlet/outlet pipe diameter, and should include two equal chambers above and below the inlet/outlet nozzles.

D. The internal coalescing medium shall consist of corrugated stainless steel sheets with 3/16" perforations and 58% open area. The coalescing medium shall be made of 304 stainless steel. The coalescing medium shall be removable to facilitate routine cleaning.

E. The separator should be capable of removing 100% of free and entrained air and 99% or more of total suspended particulate.
Provide a threaded blow down connection to allow for sediment to be regularly cleaned out of the unit, a threaded air removal connection on top of the unit so an air vent or expansion/compression tank can be connected, allowing collected air to be removed from the unit, and a threaded skim valve connection on the side of the unit to allow floating sediment to be removed.

F. Provide flanged or grooved end connections. Flange end connections should be designed according to ANSI Standards.

G. Provide a magnetic insert for removal of iron oxide and other magnetic sediment. The magnetic insert shall be made of Neodymium 45H and should have a gauss strength of at least 13,550.

2.07 AIR CONTROL FITTINGS

A. Top Outlet Boiler Fittings: Cast iron body and copper dip tube.

1. Maximum Working Pressure: 175 psig.

2. Maximum Operating Temperature: 250 degrees F.

B. Side Outlet Boiler Fittings: Cast iron body and internal dip tube.

1. Maximum Working Pressure: 125 psig.
2. Maximum Operating Temperature: 275 degrees F

C. In-Line Fittings: Cast iron body.

1. Maximum Working Pressure: 125 psig.
2. Maximum Operating Temperature: 275 degrees F.

D. Insertion Type Tank Fitting (Expansion Tanks Less Than 100 Gallons): Cast iron body with copper dip tube and water relief tube.

1. Maximum Working Pressure: 125 psig.
2. Maximum Operating Temperature: 240 degrees F.

E. In-Line Type Tank Fitting (Expansion Tanks 100 Gallons and Larger): Cast iron body with bolted and gasketed cast iron cover, internal copper U tube, stainless steel ball check, and separate dip type air vent fitting.

1. Maximum Working Pressure: 125 psig.
2. Maximum Operating Temperature: 240 degrees F.

2.08 AIR VENTS

A. Type A: Manual Coin Operated Vent; ITT Bell and Gossett Model 4V.

1. Construction: Brass.
2. Maximum Working Pressure: 150 psig.
3. Maximum Operating Temperature: 212 degrees F.

B. Type B: Automatic Float Operated Vent; ITT Hoffman Model 78.

1. Construction: Brass body with stainless steel ball check, and 1/8 inch safety drain connection.
2. Maximum Working Pressure: 150 psig.
3. Maximum Operating Temperature: 250 degrees F.

C. Type C: Automatic High Capacity Float Operated Vent; Sarco Model 13W, or ITT Bell and Gossett Model 107.

1. Construction: Cast iron body with bolted and gasketed cover, and stainless steel float mechanism, and 3/8 inch drain connection.
2. Maximum Working Pressure: 150 psig.
3. Maximum Operating Temperature: 250 degrees F.

D. Type D: Automatic High Pressure Float Operated Vent; ITT Hoffman Model 792.

1. Construction: Cast iron body (30,000 psi tensile strength) with heat treated stainless steel internal parts, and stainless steel float.

2. Maximum Working Pressure: 250 psig.
3. Maximum Operating Temperature: 300 degrees F.
4. Maximum Hydrostatic Pressure: 350 psig.

2.09 CONVECTOR HOT WATER CONTROL VALVES

A. Provide Tour & Anderson, Honeywell-Braukmann or acceptable equal convector hot water control valve with the following features:

1. The valve body shall be nickel-plated brass construction with a maximum rating of 150 psi. The valve shall have an internally threaded inlet and an outlet with a union and threaded end connection.
2. The valve shall be provided with a fully in placeable packing gland, which can be replaced without shutting down system operation.
3. The valve disc shall be constructed of EPDM capable of withstanding 250°F.
4. The valve operator shall be of the bellows design with either liquid or vapor charge. The operator shall be capable of temperature adjustment between 45°F and 86°F.
5. Provide a tamper-proof dial/operator and remote sensor consisting of an armored capillary tube sensor guard and tamper dial faceplate.

2.10 PUMP SUCTION DIFFUSERS

A. Construct unit with angle pattern cast-iron body, threaded for 2" and smaller, flanged for 2-1/2" and larger, pressure rated for 175 psi. Provide inlet vanes with length 2-1/2 times pump suction diameter or greater. Provide cylinder strainer with 3/16" diameter openings with total free area equal to or greater than 5 times cross-sectional area of pump suction, designed to withstand pressure differential equal to pump shutoff head. Provide disposable fine mesh strainer to fit over cylinder strainer. Provide permanent magnet located in flow stream, removable for cleaning. Provide adjustable foot support designed to carry weight of suction piping. Provide blowdown tapping in bottom, gage tapping in side.

2.11 PUMP DISCHARGE VALVES

A. Provide pump discharge valves as indicated. Provide non-slam check valve with spring-loaded disc and calibrated adjustment feature permitting regulation of pump discharge flow and shutoff. Design valves to permit repacking under full line pressure, and with bolt-on bonnet. Provide flanged cast-iron valve body, pressure rated for 175 psi, maximum operating temperature of 300°F (149°C). Provide straight or angle pattern as indicated.

2.12 TRIPLE DUTY VALVE

A. The valve shall be either straight or angle pattern, non-adjustable design.
B. The valve shall be a globe valve design with a spring-loaded check valve design to prevent gravity circulation and backflow and a calibrated nameplate with multi-turn stem.
C. The valve shall include a rubber memory button to allow the valve to be re-balanced to its original position after shut-off or maintenance.
D. The valve shall have a fully back-seating disc to allow the valve packing to be replaced while under pressure.

E. The valve body shall be made of either cast iron or ductile iron, the disc shall be made of brass with an EPDM rubber seat, and the stem and valve spring shall be made of stainless steel.

F. The valve shall be available with either flanged end connections or grooved end connections. Flange end connections should be designed according to ANSI Class 150 Standards.

G. Valve models with flange x flange end connections shall be rated for 175 psi maximum working pressure. Models with groove x groove end connections should be rated for 300 psi working pressure.

H. The valve shall have a maximum temperature rating of 250°F.

2.13 LIQUID FLOW SWITCHES

A. Provide liquid flow switches as indicated to sense flow and non-flow. Construct of brass for all wetted parts, provide packless construction. Provide paddle with removable segments for pipe size and flow velocity. Provide vapor-proof electrical compartment for switches mounted on cold hydronic piping systems. Furnish switches for 115 volt, 60 cycle, single phase with 7.4 amp. rating; or otherwise as indicated.

2.14 PRESSURE REDUCING VALVES

A. Provide pressure reducing valves as indicated to maintain operating pressure on the system. Brass construction, low inlet pressure check valve, inlet strainer removable without system shut-down, non-corrosive valve seat and stem, factory set at operating pressure.

Manufacturers: Bell & Gossett Model B7-12 (adjustable range 10-25 psig), or Bell & Gossett Model #7 (adjustable range 25-60 psig) or acceptable equal.

2.15 COMBINATION BALANCING VALVE AND FLOW METER

A. Threaded and Soldered End Ball Style Types (3 inch size and Less):
   1. Normal Flow (3 inch size and Less): Bell & Gossett Series CB Circuit Setter Plus.
      a. Features:
         1) Body: Bronze.
         2) Ball: Brass.
         3) Seat Rings: Glass and carbon filled TFE.
         4) Readout Valves: Capped brass type with EPT internal check valves.
         5) Stem “O” Ring: EPDM.
         6) Calibrated nameplate and memory stop indicator.
      b. Maximum Working Pressure:
         1) Threaded End: 300 psig.
         2) Solder End: 200 psig.
      c. Maximum Operating Temperature: 250 degrees F.
   2. Low Flow (1/2, and 3/4 inch sizes): Bell & Gossett Series RF Circuit Setter Plus.
      a. Features:
         1) Body: Bronze.
         2) Ball: Brass.
         3) Seat Rings: Glass and carbon filled TFE.
         4) Readout Valves: Capped brass type with EPT internal check valves.
         5) Stem “O” Ring: EPDM.

6) Calibrated nameplate and memory stop indicator.
7) Soldered end connections.

b. Maximum Working Pressure: 200 psig.
c. Maximum Operating Temperature: 250 degrees F.

B. Flanged and Grooved End Ball Style Types (4 inch size and Up): Bell & Gossett Series CB Circuit Setter.
1. Features:
a. Body and Bonnet: Cast iron (flanged end type) or ductile iron (grooved end type).
b. Disc: Bronze with EPDM insert.
c. Stem: Stainless steel.
d. Packing: Replaceable, teflon-graphite (asbestos free).
e. Gasket: Synthetic fiber-nitrile binder (asbestos free).
f. Seal Ring: EPDM.
g. Bushing: Zinc plated steel.
h. Calibrated nameplate and memory stop indicator.
2. Maximum Working Pressure: 175 psig.
3. Maximum Operating Temperature: 250 degrees F.

C. Portable readout meter with hoses, shutoff valve and vent valve, and carrying case (B&G Model RO-5 or equal).

2.16 FLOW METERING FITTINGS

A. Venturi type, complete with quick disconnect valves, safety shut-off valves, with a metal identification tag chained to each fitting. Include the following stamped data on tag: Pipe size, venturi series, station identification and meter reading at design flow rate. Maximum pressure loss through metering fittings shall not exceed 10% of the created differential pressure. One piece brass, screwed ends. Manufactured by Barco; Robertson; or Victaulic.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the work of this section in accordance with the manufacturer’s written instructions.

B. Diaphragm-Type Compression Tanks: Install diaphragm-type compression tanks on floor as indicated, in accordance with manufacturer's instructions. Vent and purge air from hydronic system, charge tank with proper air charge as recommended by manufacturer.

C. Combination Air Separator and System Strainer: Install the Work of this Section in accordance with the manufacturer's printed installation instructions.

D. Air Separator: Install in-line air separators in pump suction lines. Connect inlet and outlet piping. Install piping to compression tank with 1/4" per foot (2%) upward slope towards tank. Install drain valve on units 2" and over.

E. Chemical By-Pass Feeder / Filter: Provide each hydronic system with an independent chemical by-pass/feeder system. Installed accordance with manufacturer's printed

installation instructions, complete with isolation valves, unions and bottom drain (ball) valve.

F. Air Control Fittings: Install piping to compression tank with 1/4" per foot (2%) upward slope towards tank. Install drain valve on units 2" and over.

G. Manual Vent Valves: Install manual vent valves on each hydronic terminal at highest point, and on each hydronic piping drop in direction of flow for mains, branches, and runouts, and elsewhere as indicated.

H. Automatic Vent Valves: Install automatic vent valves at top of each hydronic riser and elsewhere indicated. Install shut off valve between riser and vent valve, pipe outlet to suitable plumbing drain, or as indicated.

I. Glycol: Install glycol in accordance with manufacturer's printed installation instructions.

J. Convection Hot Water Control Valves: Install the Work of this Section in accordance with the manufacturer's printed installation instructions.

K. Pump Suction Diffusers: Install on pump suction inlet, adjust foot support to carry weight of suction piping. Install nipple and shutoff valve in blowdown connection. After cleaning and flushing hydronic piping system, but before balancing of hydronic piping system, remove disposable fine mesh strainer.

L. Pump Discharge Valves: Install in horizontal or vertical position with stem in upward position; allow clearance above stem for check mechanism removal. After hydronic system has been completed, mark calibrated name plate with stripe of yellow lacquer to permanently mark final balance position.

M. Liquid Flow Switches: Install liquid flow switches on inlet to water chiller, inlet to water condenser, and elsewhere as indicated. Install in horizontal pipe with switch mounted in tee on top of pipe with minimum of 24" of straight pipe with no fittings both upstream and downstream of switch. Remove segments of paddle to fit pipe in accordance with manufacturer's instructions. Wiring of liquid flow switches is specified in applicable Division-23 sections, and is included as work of this section.

N. Pressure Reducing Valves: Install for each hot water boiler and heat exchanger as indicated, and in accordance with manufacturer's installation instructions.

O. Install flow metering fittings in accordance with the manufacturers printed installation instructions.

END OF SECTION 232006

SECTION 232123 - PUMPS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Product Data: Catalog sheets and installation instructions for each type or size pump.

B. Schedule: Pump schedule showing pump specifications and application.

C. Quality Control Submittals: Performance curves for each pump, showing gpm, brake HP and efficiency from free delivery to shut-off. Chart curves on manufacturer's factory tests shall be conducted in accordance with the recommended procedures of the Hydraulic Institute, and certified thereto by the manufacturer.

D. Contract Closeout Submittals: Operation and Maintenance Data: Submit 2 copies to the Engineer, incorporated within maintenance manuals, covering the installed products.

1.02 MAINTENANCE

A. Spare Parts: Deliver one spare set of mechanical seals for each size and type of in-line, coupled and base mounted circulating pump to the Owner's Representative, who will sign receipt for same. Provide seals of type as required for the particular pump application and the chemical water treatment being utilized. Suitably box and label spare seals as to their usage.

B. Parts List: Submit complete parts list for each type of pump or pumping apparatus.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Taco
Bell & Gossett
Aurora Pumps

2.02 PUMPS - GENERAL

A. Provide pumps that will operate continuously without overheating bearings or motors at every condition of operation on the pump curve, or produce noise audible outside the room or space in which installed.

B. Provide pumps of size, type and capacity as indicated, complete with electric motor and drive assembly, unless otherwise indicated. Design pump casings for the indicated working pressure and factory test at 1-1/2 times the designed pressure.

C. Provide pumps for ethylene glycol usage as specified for water, of type as indicated.

D. Provide pumps of the same type, the product of a single manufacturer, with pump parts of the same size and type interchangeable.

E. Provide pumps using oil for lubrication, with the exception of in-line circulating and close coupled pumps, with constant level oilers.

F. Provide base mounted pumps with metal guards installed over the moving drive assembly. Fabricate guards from expanded galvanized metal or galvanized sheet metal, designed to meet all safety codes. Secure guards as required and acceptable.

G. When variable frequency drives are used to control pump speed provide the manufacturer's recommended flexible coupling capable of operating at various torque and speed ratings. Coordinate with drive manufacturer.

2.03 CIRCULATING WATER PUMPS

A. In-Line Pump: Provide single stage volute type pump, with a cast or forged bronze impeller, replaceable mechanical seals, oil lubricated shaft sleeve bearings and a cast iron casing with flanged inlet and outlet connections. Direct connect pump to electric motor with a flexible coupling.

1. Motor Requirements:
   a. Equip motor with built-in thermal overload protection.
   b. Nominal full-load three phase motor efficiency:

HP	PERCENT
1-2	84.0
3-6	88.0
7-14	89.5

B. Close-Coupled Pump: Provide a horizontal, volute, single stage, end suction centrifugal type, with mechanical seals and a casing and frame of cast iron. Design casing for a 125 psig working pressure, with a vent cock in the top and drain plug in the bottom, with flanged inlet and outlet connections. Provide bronze impeller of the closed type, keyed to shaft and held in place with a self-locking bronze impeller nut. Direct connect pump to electric motor with a flexible coupling, or shaft may be common for pump and motor. Fabricate shaft from 1035 SAE steel, with AISI Type 316 stainless steel or bronze shaft sleeves.

1. Motor Requirements:
   a. Nominal full-load three phase motor efficiency:

HP	PERCENT
1-2	84.0
3-6	88.0
7-14	89.5

C. Base Mounted Pump: Provide a horizontal, volute, single stage, end suction centrifugal pump with mechanical seals and a casing and frame of cast iron. Design casing for a 125 psig working pressure, with a vent cock in the top and drain plug in the bottom, with flanged inlet and outlet connections. Provide bronze impeller of the closed type, keyed to shaft and held in place with a self-locking bronze impeller nut. Fabricate shaft from 1035 SAE steel, with AISI Type 316 stainless steel or bronze shaft sleeves. Direct connect pump to electric motor with a flexible coupling. Mount pump and driving motor on a common cast iron base or a heavy steel bed plate, with suitable lugs for anchor bolting.

1. Provide pumps driven by motors 5 HP and larger with a drip lip type base. Pitch drip lip to pump end and terminate in a tapped drain connection.
2. Motor Requirements:
   a. Nominal full-load three phase motor efficiency:

HP	PERCENT
1-2	84.0
3-6	88.0
7-14	89.5
15-24	91.0
25-39	93.0
40-49	93.0
50-69	94.1
70-99	94.1
100-124	95.0
125 or greater	95.5

2.04 CHARTS AND DIAGRAMS

A. Lubrication Charts: Card holder with aluminum or stainless steel frame, plexiglass front and sheet aluminum card backing plate. Minimum size card 8 x 10 inches. Illustrate or type the manufacturer's recommendations for lubrication of each type pump.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in-line circulating pumps between pipe flanges in piping systems. Install overhead pipe supports, both sides of in-line pumps, installed in horizontal piping runs.

B. Install close-coupled, base mounted and all floor supported pumps or pumping apparatus on concrete pump foundations, or vibration isolating bases, or both, all as noted on drawings or specified. Level, align, and true the equipment utilizing steel shims. Bolt to construction and grout, when grouting holes are provided in bases.

END OF SECTION 232123

SECTION 232514 - WATER TREATMENT - CLOSED CIRCUIT COOLERS

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Catalog sheets, brochures, performance charts, standard schematic drawings, specifications and installation instructions for the complete system.

B. Quality Control Submittals:

1. Test Reports: Furnish and deliver to the Engineer, written copies of test results conducted on all systems treated under the Work of this contract.

C. Contract Closeout Submittals:

1. Operation and Maintenance Data: Provide written instructions, framed under rigid plastic, on the procedures, test required and dosages to be used for each chemical treatment system.
2. Warranty: Copy of specified warranty.

1.02 QUALITY ASSURANCE

A. Consultant Water Conditioning Company:

1. Provide the services of an independent professional water conditioning company for the testing and chemical treatment of heating and air conditioning water systems installed under the Work of this contract, as accepted by the Engineer.
2. The water conditioning company shall make an analysis of the year round raw water supply to the building and recommend the chemical dosages to be used and shall periodically check, at least 6 times a year, on the effectiveness of the treatment, prior to final payment on this contract.
3. The water conditioning company shall train operating personnel, selected by the Owner, in the procedures and tests required to maintain chemical control, and shall during the period of the guarantee make at least 6 periodic visits to check the effectiveness and adequacy of the chemical treatment.

1.03 WARRANTY

A. The Consultant Water Conditioning Company and the (Sub)Contractor shall warranty in writing, that the water systems and any component parts thereof, will experience no more than minimal scale formation, corrosion, pitting, algae and slime growth, for a period of one year from the date of final certificate on this project, when treated in strict accordance with the Consultant Water Conditioning Companies recommendations.

1.04 MAINTENANCE

A. Extra Materials: Before final payment, deliver to the Owner's Representative at the site, a one year supply of water treatment chemicals for each system installed under this contract. The one year supply of chemicals will be used by the Owner's Operating Personnel, for the treatment of the water systems, during the period of the Warranty.

PART 2 PRODUCTS

2.01 MANUFACTURER'S/COMPANIES

Chemenergy
Bond Chemical Co.
Dearborn Chemical Co.
Heating Economy Services, Inc.

2.02 SYSTEMS REQUIRING TREATMENT

A. Equipment:

1. One closed circuit fluid cooler.

B. General Note:

1. Refer to drawings for capacities of all equipment and systems, and the entering and leaving temperatures of water for all equipment and systems.

2.03 EQUIPMENT FOR TREATMENT OF CLOSED CIRCUIT COOLERS

A. Controller for monitoring and controlling total dissolved solids and algae growth with water meter actuated timer. Controller shall be microprocessor based with keyboard activated hand/off/auto control of all relay outputs and alphanumeric display. Controller shall operate solenoid bleed valve and chemical feed pumps for dual biocide treatment and corrosion and scale inhibiter treatment. Controller shall be Chemenergy Pulsatrol Model MCT210CF; or acceptable equal.

B. Chemical feed pumps shall be solenoid driven with adjustable rate and stroke length. Chemenergy Pulsatron A Plus; or acceptable equal.

2.04 TEST EQUIPMENT

A. Metal test cabinet, similar to Model 100, as manufactured by Chemenergy, complete with sufficient glassware and reagents to make each of the following determinations once a day, for the period of the contract and the guarantee:

1. pH by color comparator.
2. Chromate by color comparator and titration.
3. Nitrite by color comparator and titration.
4. Total dissolved solids by concentration hydrometer.
5. Chlorides by titration.
6. Phenolphtalain and methyl orange alkalinity by titration.

2.05 CHEMICALS

A. As required by water analysis.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install chemical treatment systems, complete with all feeders, valves and piping, as indicated on the drawings, and as required for the treatment of all systems.

B. Install test cabinet complete with all glassware and reagents, at location as directed by the Owner's Representative.

3.02 FIELD QUALITY CONTROL

A. It is the intent of these specifications to provide complete systems of chemical treatment to protect Closed Circuit Fluid Cooler systems from scale formations, corrosion, algae and slime growth.

B. Until final payment is made on this project, chemically treat all water systems for scale formation, corrosion control, algae and slime growth, all as directed by the Consultant Water Conditioning Company.

3.03 TRAINING

A. Upon completion of the installation, adjustment and operational testing of water treatment systems, a field engineer in the employ of the water treatment manufacturer, shall for a period of 4 hours, instruct duly authorized Owner's Personnel in the operation and maintenance of the installed systems. The aforementioned hours of instruction shall not include any time spent by field engineers in the start-up, adjustment or calibration of the systems, and this instruction time shall be as scheduled and recorded by the Owner's Representative.

END OF SECTION 232514

SECTION 232515 - GLYCOL FEED SYSTEM

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, standard schematic drawings, specifications and installation instructions.

B. Contract Closeout Submittals

1. Operation and Maintenance Data: Provide one copy of written instructions, framed under rigid plastic, on the procedures, tests required and dosages to be used for the treatment of the system.

1.02 MAINTENANCE

A. Extra Materials: Provide feed tank with 50 Gallons of 40% premixed glycol solution tank shall be full at project close-out.

PART 2 PRODUCTS

2.01 MANUFACTURERS/COMPANIES

J. L. Wingert Co. - Model #GL50-E1
Neptune Chemical Pump Company – Model #G-50-1A

2.02 AUTOMATIC GLYCOL FEED PACKAGE

A. Automatic glycol feed package: shall consist of a polyethylene tank, hinged polyethylene lid, carbon steel frame, 120/1/60 with power cord plug, NEMA 4X control panel, low level float switch, 1/3HP open motor bronze gear pump with internal relief valve, pressure switch, relief valve, check valve, Schedule 80 PVC plumbing and vinyl braided hose. Contractor assembled systems are not acceptable.

i. Tank and Frame: Polyethylene tank shall be industrial grade with a nominal wall thickness of 1/4”. Shoebox type lid shall be 1/3 the diameter hinged with 304 stainless steel piano hinge and 316 stainless steel rivets. Tank frame shall be constructed of carbon steel with bracing for plumbing and control panel. Tank frame shall have 10 gauge pump mount shelf and be coated with water based enamel paint.

ii. Pressure Switch: Pressure switch will be prewired to control panel to turn on and off the gear pump based on rising and falling pressure settings.

iii. Control Panel: Fiber filled polycarbonate NEMA 4X control panel shall be of ample size for equipment needed and servicing of electrical components. All exterior components shall be rated NEMA 4X and installed per manufacturers instructions. Wiring and wiring diagram shall be color-coded for easy trouble shooting. All internal wire shall be 16-gauge minimum. Controls are, but not limited to, main power switch and indicator light, pump hand/off/ auto switch

and indicator light, and red low-level indicator light, audible alarm with push button silence and dry contact for low level indication.

iv. Pressure Relief Valve: Valve will incorporate a gauge with pressure range relative to system pressure settings.

v. Check Valve: Back flow check valve shall be tapered valve body design with an enlarged valve chamber to reduce valve chatter. PVC construction with stainless steel spring and raised radius valve seat for positive seal.

vi. Low Level Switch: Polypropylene low level switch shall be interlocked with pump feed and low level indicator. Low level will stop all pump operations when level falls below the factory set point.

vii. Provide one year manufacturer's warranty from date of substantial project completion

viii. Provide dual outlets with the capability for the feeder to supply two separate systems simultaneously.

2.03 PROPYLENE GLYCOL

A. The heat transfer medium shall be at 40% by volume inhibited propylene glycol mixture (fluorescent yellow fluid color) of Dow Chemical Co. - Dowfrost HD.

B. All manufacturers recommendations in regard to filling, initial system cleaning, and purging shall be adhered to completely.

C. Provide final water / glycol analysis report.

PART 3 EXECUTION

3.01 INSTALLATION

A. Automatic Glycol Feed Package, complete with valves and piping, as recommended by the equipment manufacturer and indicated on the drawings.

B. Glycol System(s): following system cleaning, fill specified glycol system and feed tank to indicated percentage of glycol/water solution indicated. Glycol feed tank shall be topped off at project closeout.

C. Connections or extension of existing glycol piping systems: Prior to connecting to the existing system(s), take sample of fluid and provide test reports of the existing fluids concentration of glycol and residuals to the Owner for acceptance. If the test results have not been provided prior to connection, the Contractor shall be held responsible in bringing the entire hydronic system within acceptable specifications. Top off the glycol feed tank at project closeout.

3.02 FIELD QUALITY CONTROL

A. Test the system for the concentration of glycol and residuals and provide test results to engineer for approval.

B. Furnish a qualified representative to train operating personnel, selected by the Owner, in the procedures and test required to maintain the system.

END OF SECTION 232515

SECTION 23 - METAL DUCTWORK

PART 1 - GENERAL

1.01 REFERENCES

National Fire Protection Association (NFPA).
Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Current published edition.
American Conference of Governmental Industrial Hygienists (ACGIH).

1.02 SUBMITTALS

A. Fabrication Drawings: Submit 1/4" = 1'-0" (minimum) scaled reproducible drawings of metal ductwork and fittings including but not limited to: ductwork layout detailing, sizes, fabrication lengths, locations, elevations, slopes of horizontal runs. In addition, indicate wall and floor penetrations, lighting, diffuser, building walls, steel locations with elevations and reflected ceilings (ceiling type and elevations noted). Show interface and space relationships between all items located above ceiling including but not limited to ductwork and equipment. (Submission of Engineers contract document Drawings will not be acceptable).

B. Shop Drawings: Submit duct construction standards to include schedule of all ducted air systems (indicating pressure class, materials, and seal class), sheet metal type, connections, reinforcement, turning vanes, fitting types, method of support, upper hanger attachment, and duct liner specification.

1.03 QUALITY ASSURANCE

A. SMACNA: Gages of materials, fabrication, reinforcement, sealing requirements, installation, and method of supporting ductwork shall be in accordance with the following SMACNA manuals, unless otherwise shown and/or as specified:

1. HVAC Duct Construction Standards – Fourth Edition 2021.

B. Conform to the applicable requirements of NFPA 90A, 90B and 96.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Steel: ASTM A653 lock forming quality - galvanizing: ASTM A924 coating designation G-90.

2.02 FABRICATION

A. Fabricate all ductwork in accordance with this specification and SMACNA.

B. Fabricate all ductwork from galvanized steel as indicated.

C. Round and flat oval ductwork shall be fabricated using spiral seam construction only.

Snaplock seams are not allowed

D. Rectangular and Round ductwork radius of all 90º through 45º elbows shall be 1.5 times the elbow diameter, unless otherwise noted. The radius of all 15º through 30º elbows shall be 1.0 times the elbow diameter. Mitered elbows shall be provided with turning vanes. Rectangular square throat 90º without turning vanes are not allowed.

E. Dissimilar Metals: Separate dissimilar metals used for ductwork with 10 oz. canvas impregnated with zinc chromate. No separation is required between screws or rivets and the materials in which they are inserted.

F. Sheet Metal:

1. Minimum Rectangular Duct Construction to 2" W.G. unless noted otherwise on the contract drawings. For pressure class above 2" refer to SMACNA standards tables.
2. All ductwork panels 18" and greater in width/height, 20 gage or less shall be cross broken or beaded. Internally lined ductwork is exempt from this requirement.
3. Duct construction: reinforcement, gages and sealing on fittings, elbows and short lengths of ductwork shall be continuous throughout the system.

Duct Dimension longest side	*Duct Length	Minimum Duct Gage	Transverse Joint Connection / Reinforcement
Up to 16"	48"	24	S-Slip & Drives (Min. 24 ga.)(c)
17" to 28"	48"	24	Flanged (a)(c)
29" to 36"	48"	24	Flanged (a)(c)
37" to 48"	48"	22	Flanged (a)(b)(c)(e)
48" to 84"	48"	20	Flanged (a)(b)(c)(e)
84" to 96"	48"	18	Flanged (a)(b)(c)(e)
97" to 108"	48"	16	Flanged (a)(b)(d)(e)
107" & UP	Refer to SMACNA Tables for pressure class specified		

a. Flanged ductwork joint connections shall be: SMACNA T-22, T-24, T-24a, T25a, T25b or slip-on flanges. (IE: Ductmate, Ward, Nexus, TDH and TDF installed per manufacturer's recommendations).
b. Intermediate reinforcement per SMACNA
c. Longitudinal seam to be Pittsburgh, (snaplock seams are not allowed).
d. Longitudinal seam to be welded.
e. Refer to SMACNA reinforcement tables for additional intermediate required reinforcements.

4. Round Duct Construction - Minimum duct wall thickness unreinforced 2" W.G. positive/negative pressure.

Duct Dimension	**Spiral Seam**
6"	28

8”	28
10”	28
12”	28
14”	28
16”	26
18”	26
19” - 26”	26
27” - 36”	24
37” - 50”	22
51” - 60”	20
61” - 84”	18

Round ductwork shall be a manufactured duct system consisting of fittings that are factory fitted with a sealing gasket and spiral duct which, when installed according to the manufacturer’s instructions, will seal the duct joints without the use of duct sealer. Round ductwork shall be fabricated using spiral seam construction. (Snaplock seams are not allowed). Acceptable Manufacturers: Lindab (SPIROsafe); Semco (Custom Air); United McGill Corporation (Uni-Gasket).

a. All fitting ends shall come factory equipped with a EPDM rubber gasket. Gasket shall be manufactured to gauge and flexibility so as to insure that system will meet all of the performance criteria. Gasket shall be classified by Underwriter’s Laboratories to conform to ASTM E84-91a and NFPA 90A flame spread and smoke developed ratings of 25/50.
b. Fitting ends shall be calibrated to dimensional tolerance standard of the associated spiral duct.
c. Fitting ends from 3” to 24” diameter shall have over edges for added strength and rigidity.
d. Elbows from 3” to 12” diameter shall be 2-piece die stamped and continuously stitch welded. All elbows 14” diameter and larger shall be standing seam gorelock construction and internally sealed.
e. The fittings shall be either spot-welded or button punched construction and shall be internally sealed. When contract documents require divided flow fittings, only full body fittings will be accepted.
f. Volume dampers as specified in 233300 - Ductwork Accessories.

5. Flat Oval Duct Construction – Minimum duct wall thickness unreinforced 2" W.G. positive/negative pressure.

Duct Width	Spiral Seam Duct Gage	Gage of Fitting
To 24"	24	20
25" to 36"	22	20
37" to 48"	22	18
49" to 60"	20	18
61" to 70"	20	16
71" to up	18	16

Flat Oval ductwork shall be fabricated using spiral seam construction. (Snaplock seams are not allowed). Acceptable Manufacturers: Lindab (SPIROsafe); Semco (Custom Air); United McGill Corporation (Uni-Gasket).

2.03 SUPPORT

A. Duct Hangers

1. Strap Hangers: As indicated below and/or same material as duct.
2. Rod Type Hangers: Mild low carbon steel, unless otherwise specified; fully threaded or threaded each end, with 2 removable nuts each end for positioning and locking rod in place. Unless stainless steel, galvanized or cadmium plated; shop coat with metal primer.

Maximum Half of Duct Perimeter	Strap @ 10 ft Spacing	Rod @ 10 ft Spacing	Strap @ 8 ft Spacing	Rod @ 8 ft Spacing	Strap @ 5 ft Spacing	Rod @ 5 ft Spacing	Strap @ 4 ft Spacing	Rod @ 4 ft Spacing
P/2 = 30"	1" x 22 ga	10 ga.	1" x 22 ga.	10 ga.	1" x 22 ga.	12 ga.	1" x 22 ga.	12 ga.
P/2 = 72"	1" x 18 ga	3/8"	1" x 20 ga.	1/4"	1" x 22 ga.	1/4"	1" x 22 ga.	1/4"
P/2 = 96"	1" x 16 ga	3/8"	1" x 18 ga	3/8"	1" x 20 ga	3/8"	1" x 22 ga	1/4"
P/2 = 120"	1 ½" x 16 ga	½"	1" x 16 ga	3/8"	1" x 18 ga	3/8"	1" x 20 ga	1/4"
P/2 = 168"	1 ½" x 16 ga	½"	1 ½" x 16 ga	½"	1" x 16 ga	3/8"	1" x 18 ga.	3/8"
P/2 = 192"	-	½"	1 ½" x 16 ga	½"	1" x 16 ga	3/8"	1" x 16 ga.	3/8"

B. Cable Hanging Systems (Gripple): Cable Hanging Systems with adjustable mechanical devices compliant with SMACNA shall consist of ready-to-use factory tested kit comprising of cable and cable end options. Crimps shall be Factory installed. All cable hanger products shall be certified as SMACNA and UL listed. All cable hangers shall have a minimum of 4:1 safety margin over the listed Safe Working Load (SWL).

C. Miscellaneous Fasteners and Upper Hanger Attachments:

1. Sheet Metal Screws, Machine Bolts and Nuts: Same material as duct, unless

otherwise specified.

2. Concrete Inserts: Steel or malleable iron, galvanized; continuously slotted or individual inserts conforming with MSS SP-58, Types 18 & 19, Class A-B.
3. C Clamps: Fee & Mason Co.'s 255L with locking nut, and 255S with retaining strap.
4. Metal Deck Ceiling Bolts: B-Line Systems, Inc.'s Fig. B3019.
5. Welding Studs: Erico Fastening Systems, capacitor discharge, low carbon steel, copper flashed.
6. Structural (carbon) Steel Shapes and Steel Plates: ASTM A36, shop primed.
7. Stainless Steel Shapes and Plates: ASTM A276 and ASTM A666.
8. Machine Bolt Expansion Anchors:
   a. Non-calking single unit type: FS FF-S-325, Group II, Type 2, Class 2, Style 1.
   b. Non-calking double unit type: FS FF-S-325, Group II, Type 2, Class 2, Style 2.
   c. Self - drilling type: FS FF - S - 325, Group III, Types 1 and 2

2.04 SEALANTS

A. Acceptable Manufacturers: Duro Dyne Corp.; Foster Products Div., H.B. Fuller Co.; Hardcast Inc.; United Sheet Metal Div., United McGill Corp.

B. U.L. Listed adhesives (liquid or mastic), scrim, or combinations thereof, as required for pressure class; suitable for system operating temperatures; compatible with media conveyed within, insulation (if any), and ambient conditions.

C. Use of duct tape or silicone caulk for sealing seams and joints is not acceptable.

2.05 ACOUSTICAL DUCT LINING

A. Requirements of Regulatory Agencies:

1. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B and should not support microbial growth as tested in accordance with ASTM G21 and G22.
2. The duct liner shall conform with the requirements of ASTM C 1071 with NRC not less than 0.70 as tested per ASTM C423 using a Type "A" mounting, and with a thermal conductivity no higher than .25 at 75□F mean temperature.
3. Installation of duct lining shall be in accordance with the appropriate SMACNA Manual installation detail on drawing as amended by this Section.

B. Acceptable Manufacturers: Johns Manville Mechanical Insulations Linacoustic RC; or approved equal.

C. Materials

1. Duct Lining: Minimum 1½" thick fibrous glass, with the side exposed to the airstream coated with a tough, acrylic polymer to guard against incursion of dust or dirt into the substrate. The surface coating shall be specially formulated with an immobilized, EPA-registered anti-microbial agent so it will not support the growth of fungus or bacteria, as determined by test in accordance with ASTM C 1071 and ASTM G21 and G22. Edge coating shall be factory applied to assure

coverage of the leading edges per SMACNA requirements. Material shall be a standard catalog item as furnished by a nationally recognized manufacturer.

2. Adhesive shall be approved by the duct liner manufacturer and shall meet ASTM C 916
3. Mechanical Fasteners: Furnish fasteners complete with weld pins and retaining clips for securing lining to ductwork. Weld pins shall not distort, mar or burn the ductwork. Acceptable Products: Graham Co. Weld Pins.
4. Sound Absorption Coefficients: Minimum acceptable coefficients as tested per ASTM C423-61 and ASTM E795

Product Thickness	Mounting Type	Octave Band (Hz)						NRC
		125	250	500	1000	2000	4000	
1½”	"A"	0.1	0.47	0.85	1.01	1.02	0.99	.85

D. Installing Duct Lining in Low Velocity Ductwork

1. Install duct lining in accordance with SMACNA "Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning Systems”, except as specified otherwise herein and indicated on drawings.
2. Ductwork dimensions noted on the drawings are the inside duct dimensions after the application of lining.
3. Bond liner to ductwork with a 100% coverage of adhesive, with the factory coated liner surface facing the airstream. Start installation of fasteners within 3" of the leading edge of all transverse joints within upstream leading edge of duct lining. Refer to drawings for installation detail.
4. All exposed leading edges and transverse joints shall be neatly butted without gaps and be coated with factory-applied edge coating or field-applied factory approved edge treatment. Metal nosings shall be securely installed over transversely-oriented liner edges facing the airstream at forward discharge and at any point where lined duct is preceded by unlined duct. In addition, coat all exposed surfaces of mechanical fasteners and sheet metal nosing with vapor barrier mastic.

2.06 SEALING REQUIREMENTS

A. Sealing Requirements

1. Construct as a minimum to the following pressure and seal class.

System	Pressure Class	Seal Class
Supply, return and outside air duct	+2”	‘A’
Exhaust and relief duct	-2”	‘A’
Dishwasher exhaust	-4”	(a)
Fume hood exhaust	-4”	(b)

(a) Duct shall be rectangular aluminum duct commercial grade with liquid tight welded seams.

(b) Duct shall be 20 gauge AISI Type 316 stainless steel with liquid tight welded seams.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Duct Cleanliness Construction Requirements
   1. Duct fabrication, shop storage, transportation to site, site storage, and installation, shall comply with SMACNA Duct Cleanliness Level B and additional requirements as indicated.
   2. Site storage area shall be clean, dry and exposure to dust minimized.
   3. Before installation of individual duct sections, they are to be inspected to ensure that they are free from all debris.
   4. The internal surfaces of the uninsulated ductwork shall be wiped to remove excess dust immediately prior to installation.
   5. Open ends on complete ductwork and overnight work-in-progress shall be sealed.

B. Install ductwork to allow maximum headroom. Properly seam, brace, stiffen, support and render ducts mechanically airtight. Adjust ducts to suit job conditions. Coordinate with all trades proposed locations of ductwork prior to installation.

C. Provide necessary transformation pieces and flexible fabric connections for ductwork connected to air handling equipment or air inlet and outlet devices.

D. All transitions shall be made with less than 30□ included angle.

E. Provide safing to properly close off all openings in ductwork or sleeves in which any duct accessory is being installed as required by irregular openings or off-size equipment. All attempts shall be made to maximize the size of the accessory to the opening or duct.

F. Ductwork installations exposed to view in finished spaces (refer to project documents) shall receive special attention by contractor. Care shall be taken to provide a neat uniform look, Round duct spiral seams shall align. Ductwork will be free of foreign matter (IE: construction debris, mud, dirt, excessive duct sealer, ETC.) Do not install damaged ductwork. Remove damaged ductwork at the direction of the engineer. Ductwork indicated to be painted (refer to project documents). Duct shall be wiped clean of grease, oils and any foreign materials not conducive to the adhering of paint.

G. Coordinate the installation of all mechanical systems. Provide sufficient space around ductwork and equipment during installation to allow the proper application of insulation. As needed insulate ducts prior to erection in place when ducts are required to be installed proximate to walls, ceilings, equipment or other ductwork, which will not permit adequate space for the installation of insulation, at a later date. Exercise reasonable care in the installation of insulated ductwork, so that insulated surfaces are in perfect condition before and after installation.

H. Ductwork seen behind registers, in other words; ductwork visible through a register (inside the duct) shall be painted using one coat of flat black metal paint (after proper surface cleaning). Paint coverage shall be that no unpainted duct will be seen. This applies to all grilles, registers and diffusers.

3.02 SEALING SEAMS, JOINTS, AND PENETRATIONS

A. Conform to SMACNA Seal Class A as a minimum regardless of pressure class except for continuously welded or soldered seams, where called for. Helical (spiral) lock seams are exempt from sealant requirements. All other duct surface connections made on the perimeter of the duct are deemed to be joints. Use of duct tape for sealing of seams and joints is not acceptable.

B. Sealing requirements shall include, but not be limited to: transverse (girth) joints; longitudinal seams; duct wall penetrations; branch and sub-branch intersections; duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum and casing abutments to building structures.

C. Pittsburgh sealing, sealant shall be applied in the Pittsburgh pocket prior to hammering. Sealant applied to the interior (back side of seam) of duct or to the exterior of seam is unacceptable.

D. Ducts and plenums connecting to louvers (intake, exhaust, relief) shall be constructed with the bottom of duct/plenum sloped so that water drains back and out of the louver or to a central drain connection within the plenum. If a drain connection is provided, pipe to nearest floor drain. The duct or plenum shall be sealed as directed in 3.02, A (above). In addition, all seams of lower 6" (or greater, if higher water level potential exists) shall be soldered, or otherwise gasketed and sealed to create water-tight seams, joints and penetrations.

3.03 DUCT MATERIAL INSTALLATION SCHEDULE

A. Fabricate supply, return, exhaust, and outside air ductwork from galvanized sheet metal except as described below:

B. Fabricate the following ductwork from aluminum:

1. Inlet and discharge ductwork connected to cooling towers and evaporative condensers.
2. Exhaust ductwork from dishwashers, scullery equipment hoods, showers, locker rooms and swimming pool areas.

C. Fabricate the following ductwork from stainless steel:

1. Supply, return, and re-circulated air ductwork connected to devices installed in surgical operating, surgical scrub-up, surgical recovery and surgical work rooms. Use AISI Type 302 or 304 stainless steel.
2. Exhaust ductwork connected to laboratory exhaust fume hoods. Install stainless steel from the individual hood to its respective fan and from the fan to the point of discharge to the outside air.
3. Dishwashing and other scullery equipment.

D. Fabricate the following ductwork from PVC Coated galvanized steel:

1. Exhaust ductwork connected to laboratory exhaust fume hoods. Install PVC coated steel from the individual hood to its respective fan and from the fan to the point of discharge to the outside air.
2. Ductwork installed underground.

3. Ductwork installed encased in concrete.

E. Fabricate the following ductwork from black steel or stainless steel:

1. Kitchen hood exhaust (grease) ducts.

3.04 ACOUSTICAL DUCT LINING

A. In all locations indicated on drawings.

B. Install duct lining the final ten feet from the inlet side of exhaust fans (excluding grease ducts & laboratory fume hood exhaust.)

C. Install duct lining from the horizontal ceiling heat pump discharge to the first branch runout or 15 feet.

D. Install duct lining in the return air ductwork from the horizontal ceiling heat pump to the nearest branch runout or 15 feet.

E. Install duct lining ten feet down stream of the variable air volume boxes.

3.05 HANGERS FOR DUCTS

A. Install hangers for ducts as specified in the SMACNA Manual, with the following exceptions:

1. Rectangular ducts up to 42 inches wide, not having welded or soldered seams, and supported from overhead construction; extend strap hangers down over each side of the duct and turn under bottom of duct a minimum of 2 inches. Secure hanger to duct with 3 full thread sheet metal screws, one in the bottom and 2 in the side of the duct.
2. Prime coat plain steel rods threaded at the site immediately after installation with metal primer.

3.06 UPPER HANGER ATTACHMENTS

A. General: Secure upper hanger attachments to structural steel or steel bar joists wherever possible.

1. Avoid damage to reinforcing members in concrete construction.
2. Metallic fasteners installed with electrically operated or powder driven tools may be used as upper hanger attachments, in accordance with the SMACNA Manual.

B. Prohibited Use

1. Drive-on beam clamps (caddy clamp), flat bars or bent rods, as upper hanger attachments.
2. Powder driven drive pins or expansion nails.
3. Powder driven or welded studs to structural steel less than 3/16 inch thick.
4. Loads in excess of 250 lbs from a single welded or powder driven stud.
5. Powder driven fasteners in precast concrete.
6. Do not use c-clamps to attach hangers in a shear type application. Use sheet

metal screws, machine bolts and nuts or welds.

C. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by ductwork support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of 5.

1. Secure upper hanger attachments to steel bar joists at panel points of joists.
2. Do not drill holes in main structural steel members.

D. Attachment to Concrete Filled Steel Decks:

1. Existing Construction: Install expansion shields.
2. New Construction: Install concrete inserts or metal deck ceiling bolts.
3. Do not attach hangers to decks less than 2-1/2 inches thick.

3.07 DUCT RISER SUPPORTS

A. Support vertical round ducts by means of double-ended split steel pipe riser clamps bearing on floor slabs or adjacent structural members, at every other floor through which the riser passes.

B. Unless otherwise specified or shown on the drawings, support vertical rectangular ducts by means of two steel angles, secured to duct and resting on floor slab or adjacent structural steel member, at every other floor through which the duct passes. Size supports as follows:

Max. Side Dimension (Inches)	Support Angle (Inches)	Secure to Duct with	Min. Bearing at Each End (Inches)
36	1 x 1 x c	Screws	2
48	1½ x 1½ x c	Bolts	3

3.08 OPENINGS THROUGH FIRE RATED WALLS & FLOORS NOT REQUIRING FIRE DAMPERS

A. Unless otherwise specified, size holes thru floors and walls in accordance with the through penetration fire stopping system being used.

B. Use through-penetration firestop devices, forming materials, and fill, void or cavity materials to form through-penetration firestops to prevent the passage of flame, smoke, fumes, and hot gasses as detailed in the UL Fire Resistance Directory, Warnock Hersey Certification Listings Book, or the Omega Point Laboratories Listings Directory. Where applicable design is not detailed in the Directories, use forming materials and fill, void or cavity material to form appropriate through-penetration firestop in accordance with printed details and installation instructions from the Company producing the approved forming materials and fill, void or cavity material.

C. Fill the annular space between the duct and the rated construction (both sides of the rated construction) with a non-hardening, intumescent, UL listed firestop product; and in the absence of manufacturer's firestop system installation instructions or Engineer's

recommendation, attach 1½" angles around the perimeter of all ducts (both sides of the rated construction).

D. Firestop through-penetration of floors, walls, partitions, ceilings, and roofs in accordance with the fire resistance rating assigned to the walls, partitions, floors, ceilings, and roofs on the General and Mechanical Construction Drawings.

END OF SECTION 233113

SECTION 233300 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 REFERENCES

ACGIH: American Conference of Governmental Industrial Hygienists.
NFPA: National Fire Protection Association.
SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.
UL: Underwriters Laboratories, Inc.

1.02 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, diagrams, standard schematic drawings, and installation instructions for each manufactured product. Submit SMACNA Figure Numbers for each shop fabricated item.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Unless otherwise shown or specified, comply with the applicable requirements of the following:

1. SMACNA: Gages of materials, fabrication, sealing, and installation shall be in accordance with the HVAC Duct Construction Standards Manual.
2. NFPA: Standards No.'s 90A, 90B, 91, 96, and 101.
3. UL: Standards No. UL181, UL555, and UL555S. Use Ul181 for flexible duct; Ul555 for fire dampers; Ul555S for combination fire/smoke damper
4. ACGIH: Follow the Hood Design Data, and Construction Guidelines for Local Exhaust Systems from the Industrial Ventilation Manual.

PART 2 - PRODUCTS

2.01 ROUND DUCT TAKE-OFFS / VOLUME DAMPERS

A. Volume dampers shall be fitting sized to slip into spiral duct as manufactured by Lindab or equal. Damper shall have the following features (Contractor fabricated dampers not acceptable):

1. Gasketed duct connections compatible with round ductwork system as specified in 233113 Metal Ductwork.
2. Locking quadrant with blade position indicator.
3. 2” sheet metal insulation stand-off.
4. Integral shaft/blade assembly.
5. Shaft mounted, load bearing bushings.
6. Gasketed shaft penetrations to minimize air leakage.

2.02 DAMPERS

A. Volume Control Dampers: Opposed blade type, frames of all welded construction

utilizing channel iron members in galvanized steel ducts, extruded members in aluminum ducts and stainless steel in stainless steel ducts. Fabricate frames of 2 inch wide x 1/2 inch legs x 1/8 inch thick (minimum) members for dampers less than 10 sq ft in size and 2 inch wide x 1 inch leg x 1/8 inch thick (minimum) for larger sizes. Fabricate blades from No. 16 gage (minimum) metal, of same material as duct in which installed, with 3 horizontal grooves, 2 turned edges and trunnions mounted in brass sleeve or ball bearings. Space bearings on maximum 48 inch centers. Single blade dampers are unacceptable for ducts over 11 inches in height. Weld motor mounting bracket to damper frame, for pneumatic or electric motor operated dampers.

B. Outside air, Relief air and Exhaust air: Dampers used on outside air and exhaust applications shall be insulated with thermally broken frame. Frame and blade edge seals shall be extruded silicone secured in an integral slot within the aluminum frame/blade extrusions and shall be mechanically fastened. Dampers shall be AMCA rated for Leakage Class 1A at 1" water gauge differential static pressure. Linkage hardware shall be aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation. Linkage hardware shall be complete with cup-point trunnion screws to prevent linkage slippage and a Celcon bearing between moving parts to reduce wear and increase longevity. Linkage that consists of metal rubbing metal will not be approved; Tamco Series 9000 BF, or approved equal.

C. Splitter Dampers: Fabricate dampers of same material as duct in which installed, with rolled or hemmed edges. Provide blades in ducts having a maximum side dimension under 24 inches of same gage as duct, and in ducts having a maximum side dimension 24 inches and over provide blades 2 gages heavier than duct.

D. Fire Dampers; Static Systems:

1. Provide UL 555 Classified and Labeled "Fire Resistance Rating 1-1/2 hr".
2. Fire damper to be Type B, Blades out of the air stream.
3. Frame to be one piece roll-formed 22Ga. galvanized steel.
4. Blades to be 22 Ga. galvanized steel, curtain type.
5. Provide damper with replaceable 165° F. fusible link.
6. Provide with closure springs for both horizontal and vertically installed fire dampers
7. Provide damper with the following options:
   a. Factory supplied sleeves
8. Design Manufacturer: Air Balance, Model 119B.

E. Fire Dampers, Dynamic Systems, Maximum size of 24x24 Horizontal or 36x36 Vertical:

1. Provide UL 555 Classified and Labeled with the following (but not limited to):
   a. Fire Damper, 1-1/2 hr fire resistance rating.
   b. For use in dynamic systems.
   c. Maximum rated air flow and pressure difference across damper.
   d. Directional arrow indicating air flow.
   e. Mounting position (horizontal or vertical, or both).
2. Fire damper to be Type B, Blades out of the air stream.
3. Frame to be one piece roll-formed 22Ga. galvanized steel.
4. Blades to be 22 Ga. galvanized steel, curtain type.
5. Provide damper with replaceable 165° F. fusible link.
6. Provide with closure springs for both horizontal and vertically installed fire

dampers

7. Provide damper with the following options:
   a. Factory supplied sleeves
8. Design Manufacturer: Air Balance, Model D19B.

F. Fire Dampers, Dynamic Systems, Larger than 24x24 Horizontal or 36x36 Vertical:

1. Provide UL 555 Classified and Labeled with the following (but not limited to):
   a. Fire Damper, 1-1/2 hr fire resistance rating.
   b. For use in dynamic systems.
   c. Maximum rated air flow and pressure difference across damper.
   d. Directional arrow indicating air flow.
   e. Mounting position (horizontal or vertical, or both).
2. Fire damper to be blade type
3. Frame to be 5-1/2" x 7/8" x 16 Ga. galvanized steel.
4. Blades to be 16 Ga. galvanized steel, 6" nominal width, parallel action.
5. Axles to be square, plated solid steel.
6. Bearing to be oil impregnated bronze.
7. Linkage to be plated steel angle and crank plates with stainless steel pivots, in-jamb type.
8. Stops to be 18 Ga. galvanized steel at head and sill.
9. Jamb seals to be stainless steel.
10. Provide damper with non-motorized spring closure mechanism with replaceable 165 Deg. F. fusible link.
11. Provide damper with the following options:
    a. Factory supplied sleeves
12. Design Manufacturer: Air Balance, Model MD19.

G. Manual Damper Regulators:

1. For Dampers Installed in Exposed, or Accessible Concealed Ductwork: Indicating quadrant with heavy metal handle and means for locking damper in all positions. On insulated ducts, quadrant to be mounted on hat channel; channel height equal to exterior duct insulation thickness. Provide bearings at both ends of operating shaft.
2. For Dampers Installed in Inaccessible Concealed Ductwork: Concealed type with indicating regulator in cast metal box with cover plate. Furnish assembly complete with duct and bearing, adjustment coupling, damper extension rods and minimum of 2 keys or socket wrenches for each type of damper adjustment screw or device. On insulated ducts, quadrant to be mounted on hat channel; channel height equal to insulation thickness. Provide bearings at both ends of operating shaft

H. Adjustable Vane Damper Assembly: Factory fabricated assemblies of same material as ductwork in which installed. Design assembly so either half of each blade may be adjusted independently, with blades held in position by friction pins. Install damper unit in collar gasketed with heavy felt. Design assembly to facilitate positive volume control and uniform air distribution over entire outlet.

I. Combination Fire and Smoke Dampers and Smoke Dampers

1. Air Balance Model FS2 250 or acceptable equal.

2. Construction Features
   a. Fabricate in accord with National Fire Protection Association.
   b. Labeled and inspected by Underwriters Laboratories, Inc.
   c. Fire resistance rating of 1-1/2 hour rated per UL Standard 555
   d. Leakage rated damper for use in smoke control systems, with a Class II/250 degree F per UL Standard 555S.
   e. Blades-16 gauge channel.
   f. 20 gauge galvanized steel sleeve (20" long).
   g. Axles-1/2" square, plated solid steel stub.
   h. Bearings-oil impregnated bronze.
   i. Linkage-fixed type in air stream.
   j. Stops-18 gauge galvanized steel.
   k. Blade Edge Seals-silicone rubber.
   l. 120 VAC Electric Actuator. Coordinate with existing fire alarm system.
   m. Dual position indication switches.
   n. Damper shall be Normally Closed.
3. Installation
   a. Install at all locations shown on drawings.
   b. Install access doors at all locations.

2.03 TURNING VANE ASSEMBLIES

A. Fabricate vane assemblies of same material as ductwork in which installed. Provide individual hollow airfoil type vanes, rigidly connected to vane rails, with rails welded, screwed, or riveted to the ductwork.

2.04 FLEXIBLE CONNECTIONS - FABRIC

A. Glass fabric coated with an inorganic elastomeric material, similar to Duro Dyne's Thermafab.

B. Factory pre-fabricated pre-assembled flexible connectors of fabric specified in A. above with minimum No. 24 USS gage metal edges similar to Duro Dyne's Metal-Fab or Super Metal-Fab as required for free fabric length.

2.05 GASKET MATERIAL

A. Registers, grilles and diffusers installed in exposed uninsulated ductwork: 1/4 inch thick felt or sponge rubber material, of width as required by the flange on the particular device.

B. Flanged joints in ducts: 1/8 inch thick reinforced inert plastic of the self-conforming type, of same width as flange.

2.06 FLEXIBLE DUCT

A. Conform with NFPA 90A, and UL 181, Class I (minimum R-6):

1. Un-insulated: Dual element construction consisting of a corrosion resistant metal support spiral, mechanically locked to reinforced coated glass fabric, conforming to NFPA Standard 90A.
2. Pre-insulated: CertainTeed's Certaflex Punchline 25; Owens-Corning's INL-25; Wiremold WCK.

3. Flexible ductwork installed in unconditioned spaces shall be minimum R-8. Refer to 230713 Duct insulation.

2.07 FLEXIBLE DUCT CLAMP

A. Heavy duty Nylon Tie Anti-slip strap body tie, ribbed and stippled to prevent axial and lateral movement. Natural heat stabilized 6.6 nylon, high tensile strength which meets or exceeds industry and military standards (MIL-S-23190E). Temperature ratings 185 de. F max, -40 deg. F min. Positive grip locking anti-spring back tip: stainless steel (316) barb, infinitely adjustable strap. Shall be installed for a tight secure fit utilizing the manufacturer's installation tool. Manufacturer Panduit or equal.

B. Stainless steel clamp: 9/16" wide band, plated 5/16" Hex head swivel action screw and bridge. Worm drive swivel action.

2.08 DUCT ACCESS DOORS

A. Fabricate minimum 16 x 16 inch size, or duct size by 16" for ducts less than 16" in width, of same material and finish as duct unless otherwise shown or specified.

1. For uninsulated duct designed for under 2 inches w.g.: Fabricate single panel door of same gage as duct, with all edges folded, size door to overlap opening perimeter by one inch.
2. Provide door with a minimum of 4 sash locks, Ventfabrics, Inc. Ventlock No. 260 or Duro Dyne Corp. Code No. SP Series. Sash Locks shall be galvanized, cadmium plated, or aluminized steel or cast aluminum.
3. For insulated duct and duct designed for 2 inches w.g. and over: Fabricate hollow metal doors in accordance with the SMACNA Manual. Fill void in doors for insulated duct with thermally equivalent insulation.
4. Provide doors with a 3/4 inch wide gasket and duct sealer around all 4 sides of duct opening at joint of access door frame and duct.

2.09 PLENUM ACCESS DOORS

A. Fabricate minimum 24" x 36" inch size, of same material and finish as plenum unless otherwise shown. Fabricate doors in accordance with the SMACNA Manual.

B. Door design shall be minimum rating of 4.5" w.g.: Fabricate door frame of .060 aluminum extrusion with 1-1/4" wide flange, double layer door panel of 18 ga. galvanized steel (G-90) with .060 aluminum extrusion frame, fill void in door with 1" thick fiberglass insulation.

C. Provide door with continuous type aluminum hinge.

D. Provide 2 locking door latches: Ventfabrics, Inc., Ventlock No. 260 or Duro Dyne Corp. Code No. SP Series.

E. Provide door with a 3/4 inch wide foam rubber gasket.

F. Provide view port: minimum 8x8 plexiglass window.

2.10 KILN VENT SYSTEM

A. Kiln Vent System complete with:

1. 44" diameter hood, counter balanced for vertical adjustment
2. 10' flex hose
3. Two speed exhaust fan
4. Programmable fan timer
5. 1/2 hp, 120V, single phase fan, utility set configuration
6. Roof exhaust duct kit with flashing
7. Cables, clamps and all mounting hardware

B. Unit shall have a 3 year warranty and meet OSHA standards. Unit shall be similar to Vent-a-Kiln.

2.11 DUCT MOUNTED SMOKE AND CARBON MONOXIDE DETECTORS

A. Furnished by electrical contractor. Installed by HVAC contractor. Wired by electrical contractor. Coordinate locations with electrical contractor.

2.12 ROOF CURB FOR DUCT PENETRATIONS NOT DIRECTLY CONNECTED TO FANS

A. Factory fabricated, double shell, aluminum, a minimum of 2" thick, insulated with mineral wool, or thermally equivalent insulation as approved. Fabricate curbs from minimum No. 18 gage aluminum, properly braced and stiffened to form a rigid weatherproof unit. Curbs shall be a minimum of 12" high.

PART 3 – EXECUTION

3.01 INSTALLATION - GENERAL

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Install manual volume control dampers in all branch ducts and take-offs.

C. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.02 TURNING VANES

A. Install turning vanes in all rectangular, round and oval square duct construction with 90° elbows and elsewhere as indicated. Small vanes shall be installed in ducts 29” wide and smaller; larger vanes shall be installed in ducts 30” and larger.

3.03 FLEXIBLE FABRIC CONNECTORS (Installation)

A. Make ductwork connections to air handling equipment with flexible fabric connectors. Install connectors with sufficient slack to prevent vibration transmission.

B. Free Fabric Length: Install fabric connectors a minimum of 3 inches in length for ducts

having a maximum diameter of 18 inches, or maximum side dimension of 30 inches, and a minimum of 5 inches in length for duct diameters over 18 inches or side dimensions over 30 inches.

C. Secure fabric connectors to fans, casings and ducts as follows:

1. Secure round connectors with No. 12 USS gage x 1 inch wide galvanized steel draw bands. Secure bands with bolts and nuts.
2. Secure rectangular connectors with 1 inch x 1/8 inch thick flat galvanized steel bars, with screws or bolts on maximum 8 inch centers, or with approved sheet metal slip joints. Tightly crimp fabric into sheet metal joint and secure complete joint with sheet metal screws on maximum 6 inch centers.

D. Fabric connectors may be factory pre-fabricated pre-assembled units, with minimum No. 24 USS gage metal edges, secured to fabric with double lock seams.

E. Do not paint fabric connectors.

3.04 ACCESS DOORS

A. Install gasketed access doors in ductwork for each motor operated damper, manually operated volume control device, smoke damper, fire damper, smoke detector, in duct heating coil and at all locations where operating parts of any kind are installed and require access and elsewhere as indicated. Access doors are not required, where a manually operated damper has an exposed damper regulator, with an indicating quadrant.

B. Install access door accessible to service personnel, providing clear use of the door entire opening, positioned in the ductwork providing servicing of the entire fire damper with-in the duct. Access door shall not be blocked by any obstructions (i.e.: pipe, conduit, other ductwork, etc).

C. Access doors provided to access fire dampers and smoke dampers shall be labeled with 1/2" tall letters (black paint) “FIRE DAMPER”, “SMOKE DAMPER” OR “FIRE/SMOKE DAMPER”. In situations where text does not fit use FD, SD or FD/SD.

3.05 CONCEALED DAMPER REGULATORS

A. Imbed box in, and secure to back-up construction in ceiling or wall, so cover plate is flush with final surface.

3.06 FLEXIBLE DUCT

A. Install flexible duct as per manufacturer's instructions. Provide intermediate support along horizontal runs to avoid excessive sagging. Maximum extended length to be 36".

B. Secure each end of inner fabric of flexible duct to diffuser and ductwork with a flexible duct clamp. Secure each end of outer jacket with a flexible duct clamp independently of inner duct clamp. Nylon or Stainless steel.

3.07 FIELD QUALITY CONTROL

A. Operate installed ductwork accessories to demonstrate compliance with requirements.

Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.08 ADJUSTING AND CLEANING

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

B. Label access doors after cleaning in accordance with Division-23 section "Mechanical Identification" and with NFPA 90A.

C. Final positioning of manual dampers is specified in Division-23 section "Testing, Adjusting, and Balancing".

D. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.09 EXTRA STOCK

A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION 233300

SECTION 233616 - VARIABLE AIR VOLUME UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUBMITTALS

A. Product Data: Catalog cuts, specifications, installation and maintenance instructions for each type of variable air volume specified.

B. Schedule: List manufacturer, unit type, model number, and performance data for each variable air volume box.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

Trane Co.
Nailor Industries Inc.
Price Co.

2.02 VARIABLE AIR VOLUME BOXES

A. General: Furnish and install Variable Air Volume Terminal Units, or approved equal, of the size, capacity, and performance as shown on the plans.

B. Performance: The air pressure drop through the terminal units shall not exceed values tabulated on the plans. Sound levels of the terminal units shall not exceed values shown. All performance data shall be tested in accordance with ARI Industry Standard 880-98. Terminal units shall be ARI Certified, rated in accordance with Standard 880-98.

C. Construction: The valve assembly is to be constructed from galvanized steel with the damper mechanically fastened to a d" shaft and isolated from the casing to eliminate the possibility of damper binding due to shipping or handling damage. The damper shaft is to rotate in oil impregnated sintered bronze bearing at three points for support and long life. The control unit, sound attenuator and multi-discharge adaptor casings are to be constructed of 24 gauge galvanized steel. Integral butterfly dampers on multi-discharge units shall be provided for balancing air quantity to remote diffusers.

D. Control Valve: The valve shall be sealed for minimum leakage. The throttling damper shall be of a sandwich design incorporating a solid sheet of Volara®, type A gasket material sandwiched between two halves of reinforced galvanized steel. The average valve leakage shall not exceed 1% at 3" inlet static pressure. Control valves shall be (Normally open)(Normally closed) as required.

E. Insulation: The adaptor insulation shall be ½" thick and have a 4 lb./cu. ft. density outer

layer laminated to an inner layer to yield a 1.9 lb./cu. ft. dual density fiberglass liner. The insulation for the model AXAB sound attenuator shall be a 2" thick, 1½ lb./cu/ ft. homogeneous density fiberglass material. The surface of the insulation for all units shall conform to UL Test 181 for erosion resistance. The insulation must be UL listed and meet NFPA 90A requirements for 250°F continuous temperature.

F. Foil Coated Insulation: The foil faced insulation shall be ½" thick, dual density fiberglass with a 0.001" aluminum foil on the matted face. The insulation must be UL listed conforming to the UL Test 181 for erosion resistance and must meet NFPA 90A requirements for 250°F continuous temperature. The edges of the insulation must be sealed so that there is no exposed fiberglass material in the airstream.

G. Electric Control: Individual 24 volt motors shall be provided for forward and reverse operation. The actuator assembly shall be direct drive mounted on the damper shaft. Valve action shall require approximately 6 from extreme positions. The electric actuator assembly shall be used in conjunction with the rapid response thermostat with forward, null and reverse positions to prevent hunting.

H. Provide pressure independent electric volume control with field adjustable maximum and minimum stops. Control action shall be direct drive to open and direct drive to close. Air volumes must be field set.

I. Balancing: Terminal units shall have flow taps and calibration chart for the purpose of measuring air flow.

J. Accessories: Air flow sensor in inlet, hanger brackets.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install variable air volume boxes in complete accordance with the manufacturer's printed installation instructions and the requirements of the Contract Documents.

END OF SECTION 233616

SECTION 236400 - PACKAGED AIR COOLED CHILLERS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all the labor, material and equipment for the installation of a complete packaged air cooled chiller system as described herein as shown in the Drawings, and as needed for a complete and proper installation. Product specific requirements are contained herein; Section 15501, General Provisions for Heating, Ventilating and Air Conditioning Work, shall be referred to for general requirements.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), furnished specialties, controls and accessories; and installation and start-up instructions for all the required refrigeration equipment. Submit specifications and installation instructions for all the controls.

The Temperature Control Contractor shall install field controls furnished by the OEM unit manufacturer.

For networked projects, system integration of the refrigeration unit control system to the Owner’s Temperature Control System shall be provided.

B. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to units. Power supply wiring shall be provided by the Division 16 Electrical Contractor. Submit manufacturer's wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions that must be field installed by the Temperature Control Contractor.

C. Quality Control Submittals

1. Submit certification of compliance with specified ARI, UL and ASHRAE fabrication requirements.

2. Submit certification of compliance with NYC Buildings Department, Fire Department, Bureau of Gas & Electricity, and any other municipal agency having jurisdiction.

3. Factory testing affidavits of chiller and air cooled condenser.

D. A complete system layout drawing indicating all piping, wiring, accessories and any other items required for the refrigeration system together with complete details drawings of the chillers, air-cooled condenser assembly, pressure vessels, regulating valves, strainers, etc., shall be submitted and approved before installation. Layout drawings that had received prior approval shall be so indicated on the Drawing.

E. Refrigerant pipe passing through the roof: Submit detail drawings for approval before commencing with this phase of the Work.

F. Agency permits and approvals

G. All Guarantees signed by the Manufacturer specified in this Section

H. Maintenance materials

I. Start-up service reports

J. Operation and Maintenance Data: Submittals shall include all the required refrigeration equipment (belts, etc.) including the emergency operation and maintenance manuals; and the maintenance data specified in Section 15501.

K. Certificate: Contractor's start-up and demonstration affidavit

1.03 SUPPLEMENTAL QUALITY ASSURANCE

A. Codes and Standards

1. Capacity ratings shall be in accordance with ARI Standard.

2. Refrigeration system shall be constructed in accordance with ASHRAE 15: Safety Standard for Refrigeration Systems and ASHRAE 34.

3. Air Cooled Condensers shall meet or exceed the minimum COP/Efficiency levels as prescribed in the 2020 Energy Conservation Construction Code of New York State

4. All electrical components shall be UL listed and labeled.

5. Comply with the 1990 Clean Air Act and all other Federal, State and City Codes and Regulations.

6. NFPA latest recommendations.

B. Before submitting any equipment shop drawings for approval, the HVAC Contractor, Automatic Temperature Controls Contractor and the Equipment Vendor and Manufacturer shall coordinate the controls required for the system.

1.04 SEQUENCING AND SCHEDULING

A. Coordinate layout of equipment supports and penetrations for roof-mounted units.

B. Coordinate size and location of concrete equipment bases for ground mounted units.

C. Coordinate rough in of refrigerant piping and electrical service.

1.05 GUARANTEE

A. Provide a written five-year guarantee for all compressors signed by the manufacturer. All other components shall be guaranteed for a two-year period by the manufacturer. All guarantee starting dates shall be the date of Substantial Completion.

1.06 MAINTENANCE

A. Furnish all the tools required to maintain the refrigeration equipment. Furnish spare set of belts for the belt driven fans.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide a complete system for the production of chilled water as described herein and as shown in the Drawings. The system shall be complete with all necessary refrigeration equipment, such as compressors, evaporators, condensers, receivers, mufflers, special controls, gauges, thermometers, control panel, valves, strainers, piping, refrigerant charge, flexible connectors and all other items and accessories as hereinafter specified, shown on the Drawings or required for a complete installation.

B. Refrigerant R-513a shall be used, or approved equal.

2.02 PACKAGED AIR COOLED CHILLER

A. Provide factory assembled, piped, wired and fully charged split liquid chillers in the location and of the number and capacity shown on the Drawings. Each unit shall be complete with compressor(s), insulated chiller, starter, dual pressure switch, differential oil pressure switch, expansion valve, solenoid refrigerant valve, safety thermostats, temperature controller, pressure relief valves, charging valves, sight glass, oil strainer, liquid line drier and strainer, discharge, suction and oil pressure gauges with shut-off valves. Operational indication lights for power on, oil failure, hi-lo pressure cutout, and low temperature cutout shall also be included.

B. Compressor:

1. Helical rotary screw compressor: construct helical rotary screw compressors with heat treated forged steel or ductile iron shafts, aluminum alloy connecting rods, automotive type pistons, rings to prevent gas leakage, discharge valves, and sealing surface immersed in oil. Rotors shall be of high-grade steel alloy. Statically and dynamically balance rotating parts. Provide oil pump lubrication system with oil charging valve and oil filter to ensure adequate lubrication during starting, stopping, and normal operation. Provide compressor with automatic capacity reduction equipment consisting of capacity control slide valve (rotary). Use lifting mechanism operated by solenoid valve. Compressor must start unloaded for soft start on motors. Provide constant speed 3600 rpm compressor motor, suction gas cooled with solid state sensor and electronic winding overheating protection, designed for across-the-line. Provide with starter. Provide crankcase heater to evaporate refrigerant returning to crankcase during shut down. Energize heater when compressor is not operating.

2. The compressor shall start unloaded, and shall have 3-step (minimum) capacity modulation, controlled either by suction pressure or by chilled water inlet temperature. Compressor motor shall have at least two hermetic thermostats located in the motor windings to prevent motor overheating. Compressor motors exceeding 25 horsepower size shall be designed for part-winding start.

3. Starters for the compressor motors shall be either part-winding type or across-the-line magnetic type and shall have overload relays in each of three legs. Provide a phase-failure-phase-reversal relay for each compressor starter. This relay shall be of the proper size and type of current. Provide on/off switch in the cover of each compressor starter. A chiller having multiple compressors shall be provided with a fused disconnect switch, mounted on or near the chiller, for each compressor motor. Also provide all auxiliary contacts required for control equipment, as specified in other paragraphs of this Section, as well as an auxiliary contact for flow switch specified in Section 15515: Hydronic Specialties.

C. Chiller evaporator shall be shell-and-tube type with removable heads. It shall be completely covered with an insulating material complying with the requirements of the NYC Construction Codes. Tubes shall be of copper, with finned inserts. Chiller shall be constructed in accordance with ASME Code for unfired pressure vessels, and shall be tested, inspected and stamped accordingly. Chiller shall be shipped with a positive dry nitrogen holding charge. Chillers shall have independent refrigerant circuits on multiple compressors units and one refrigerant circuit on single-compressor units.

D. Control Panel:

1. The chiller shall be provided with a factory installed and wired control panel containing the starters, pressure switches, temperature controls, pilot lights, electrical interlock with the air cooled units and any other associated electrical equipment required for proper operation of the system as designed. The control shall maintain the required chiller temperature. Refer to Section 15985 for the Sequence of Operations for the chiller.

2. Provide all the required safety controls for automatic shutdown protection with manual reset.

E. All components of the chiller, including accessories, shall be factory tested for performance prior to shipment. Controls and connections shall be clearly marked. Chillers shall be installed on vibration absorbing supports, as specified in Section 15504.

F. Oil Separator-Muffler: provide in the discharge of each compressor, a muffler and an oil separator, or a single device combining the two functions. The muffler-separator shall function to reduce hot gas pulsations and to extract oil entrained in the hot refrigerant gas and return it to the compressor oil supply. It shall be constructed in accordance with ASME Code, and shall be sized to suit the compressor furnished. Muffler-separator shall be furnished by the chiller manufacturer.

G. Casing shall have a phosphatized, or equal, treatment and shall be furnished with two coats of alkyd enamel or other approved corrosion resistant paint. Aluminum casing of not less than No.12-gage also is acceptable. Provide access panels to motors, drives and coil connections.

H. Condenser coils shall be constructed from aluminum fins mechanically bonded to internally finned aluminum tubing tested at 525 psig minimum. Provide a factory applied epoxy coating.

I. Each condenser shall be equipped with direct drive propeller type fans. Motors shall be drip-proof type and shall be provided with thermal overload protection. Fan discharge shall be fitted with close mesh electro galvanized or aluminum fan guard.

2.04 HEAD PRESSURE CONTROL

A. An automatic head pressure control system shall be provided complete with all required auxiliaries, controls and piping as part of each refrigeration system. The control system shall function to permit operation of the refrigeration system at ambient temperatures as low as 32 degrees F. The head pressure control shall be provided by the chiller manufacturer.

2.05 EMERGENCY CHILLER STOP STATION

A. The Contractor shall provide in the locations shown on the Drawings, ASCO 1242 (minimum 2 pole) or approved equal, flush mounted break glass stations, with appropriate approved designation, for emergency shutdown of the chillers. All wiring to the chiller control panels shall be by the Electrical Contractor. Refer to Section 16480.

2.06 REFRIGERATION EQUIPMENT CONTROL POINTS

A. Temperature Controls Contractor (TCC) shall provide integration of monitoring and alarm functions by providing controls as indicated on the Drawings and in Contract Specification Sections.

B. Control System "Gateway"

1. The manufacturer of the Chiller Plant Controller shall provide either a Lon Card or a protocol translator gateway for native control systems that are not LonWorks compliant in accordance to the LonTalk protocol (ANSI approved standard EIA/CEA-709.1-A-1999).

2. The protocol translator gateway shall enable the Chiller Plant Controller network devices to communicate directly with the Owner's LonWorks based network.

3. Provide interoperable protocols as specified below for each approved chiller manufacturer. Alternative "open system" protocols such as Modbus, Profibus, are subject to approval of the Owner's Architect/Engineer of Record and Commissioning Owner.

4. The data transfer between Modbus/Profibus (or the chiller manufacturer's protocols specified) and the LonTalk protocol shall provide the required Standard Network Variable Types (SNVTs) and configuration parameters to monitor the chiller plant from the LonWorks based networked system using the LonTalk protocol.

5. The data transfer between the Manufacturer's chiller control panel and the Owner's LonWorks based network system is to be accomplished using a Lon Card or Field Server protocol translator gateway and additional integration hardware specified below per the requirements of the Commissioning Owner. All the required software and configuration files shall be provided and be downloadable via the serial or Ethernet port of the gateway.

6. Where the use of a unique proprietary protocol is utilized by the chiller manufacturer, a custom designed configurable "gateway" shall be provided by the manufacturer of the chiller. Use of a unique chiller manufacturer proprietary protocol is subject to the approval of the Commissioning Owner.

C. The chiller manufacturer shall coordinate with the Temperature Controls Contractor (TCC) to demonstrate the proper integration of the chiller control system to the satisfaction of the Commissioning Owner and in accordance with the requirements of the Owner's Specifications.

1. The Trane Company: Control Panel System Integration Requirements:

   a. The chiller manufacturer shall provide a LonTalk gateway (BCU panel or approved equal) to interface the Integrated Comfort System (ICS) chiller controller to the Owner's LonWorks network system.

   b. In lieu of the above, the chiller manufacturer shall provide a LonWorks based native chiller control panel, where available, and only if the LonWorks card provides the available chiller data points in the LonTalk protocol that are identical to the data points available with the gateway. Refer to the Drawing details that define the minimum points to monitor.

   c. The chiller manufacturer integration submittal is subject to the approval of the Architect/Engineer of Record/Commissioning Owner.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all refrigeration equipment is installed in accordance with pertinent codes and regulations, the original design, and the referenced standards. Verify roof structure, mounting supports, and membrane installations are completed to the proper point to allow installation of roof mounted units. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 INSTALLATION OF INDOOR PACKAGED AIR COOLED CHILLER

A. Install chillers in accordance with manufacturers' written installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances. Clearances shall be maintained around all components so as to permit inspection, servicing, repair, replacement and visibility of all gauges. When units are installed or replaced, clearance shall be provided to allow access for inspection, maintenance and repair. Passageways around all sides of the units shall have an unobstructed width as required by the manufacturer.

B. Concrete, formwork, and reinforcing are specified in Section 03300: Cast-in-Concrete. Coordinate installation of anchoring devices. Install all the vibration absorbing supports per Section 15504.

C. Install Oil Separator-Muffler complete with all the piping, valves, brackets, and all other items and accessories as recommended by the chiller manufacturer.

3.03 MISCELLANEOUS INSTALLATION

A. Installation of system shall conform to U.S.A. Standards Association B9.1 Safety Code for Mechanical Refrigeration.

3.04 ELECTRICAL WORK

A. The Division 26 Electrical Contractor shall provide service wiring to the starter-disconnect switch at each condenser, provide blank conduits from the condensers to the control area in the Equipment Room, provide a disconnect switch for each chiller in this room.

B. The Division 26 Electrical Contractor shall provide Hand-Automatic starter for the Mechanical Room ventilation fans. The Division 16 Electrical Contractor shall provide signal wiring from Refrigerant Monitor dry contact output to Mechanical Room ventilation fans H-A starter.

C. The Division 26 Electrical Contractor shall provide all wiring, switches, conduit and controls, as herein specified, shown on the Drawings, or necessary for a complete installation from the disconnect switches to the control panel for the refrigeration equipment. Temperature Control Contractor shall install OEM furnished and required interlock wiring between the chillers and the circulating pumps and associated field devices. All wiring shall be in accordance with the NYC Electrical Code.

3.05 CONTROL SCHEME

A. Refer to the Sequence of Operations.

3.06 FIELD QUALITY CONTROL

A. Provide the services, to include a written report, of a factory authorized service representative to examine the field assembly of the components, installation, and piping and electrical connections. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.

3.07 ADJUSTMENT

A. Refrigeration equipment shall be installed under the direction of the chiller manufacturer's representative. All adjustments, alterations, etc., necessary to make the apparatus fully operative for the purposes intended, shall be made.

B. The chiller manufacturer shall furnish the services of a factory trained representative for a total of two consecutive normal working days to supervise the pressure testing, evacuation, charging, and initial start-up of the unit, and to concurrently instruct the Owner. The Contractor shall also deliver to the Owner at this time a complete written set of installation and operating instructions, a copy of which shall be submitted with the Shop Drawings. Contractor shall give written notice to the Owner at least 2 days before initial start-up.

3.08 DEMONSTRATION

A. Provide the services of a factory authorized service representative to provide start-up service and to demonstrate and train the Owner designated personnel, Custodian, and DOE Maintenance Representative as specified. Contractor shall submit written affidavit stating that all equipment is operating as designed.

B. Start-up service: place units into operation and adjust controls and safeties. Replace damaged or malfunctioning chiller components and factory provided controls. The Contractor shall perform necessary Interdisciplinary Tests and Functional Performance Tests (FPT) according to manufacturer’s procedures.

C. The Temperature Control Contractor shall demonstrate the proper functioning of the chiller control system integration from its chiller panel protocol into the Owner's network per the requirements of these specifications to the satisfaction of the Owner's Commissioning Owner. The Chiller manufacturer shall replace damaged or malfunctioning components, controls, and software installed under his/her contract.

D. The Temperature Control Contractor shall demonstrate the proper functioning of the Temperature Control System to the satisfaction of the Owner's Architect/Engineer of Record/Commissioning Owner. The Temperature Control Contractor shall replace damaged or malfunctioning components and controls installed under his/her contract.

E. Training:

1. Train the Department of Education Custodian or building manager and DOE Maintenance Representative on start-up and shutdown procedures, troubleshooting procedures, and servicing and preventative maintenance schedules and procedures. Review with the personnel, the contents of the Operating and Maintenance Data specified in Divisions 1 and 23.

2. Schedule training with Owner personnel, Custodian and District Maintenance Representative with at least 2 days prior notice for a period of 2 consecutive days.

3.09 INTERDISCIPLINARY TESTS AND FUNCTIONAL PERFORMANCE TESTS

A. Interdisciplinary Pre-Start-Up and Start-Up Tests:

The Contractor shall conduct interdisciplinary pre-start up and start up tests as per the manufacturer's start up procedures. Contractor shall submit signed start up affidavit signed by the factory authorized service representative indicating that all of the manufacturer's pre-start up and start up procedures have been successfully completed.

B. Functional Performance Tests:

Contractor shall also submit signed functional performance testing affidavit signed by the factory authorized service representative indicating that all of the manufacturer's functional performance tests have been successfully completed.

3.10 SIGNS, NAMEPLATES AND OPERATION AND EMERGENCY SHUTDOWN INSTRUCTIONS

A. Signs, nameplates, and operation and emergency shutdown instructions for refrigeration systems shall comply with the following:

1. Sections 9.15, 11.2.1, 11.2.2 and 11.7 of ASHRAE 15 as identified below.

2. Each refrigeration unit or system shall be provided with a nameplate indicating the "rated" horsepower of the prime mover or compressor and the equivalent of such horsepower in kilowatts.

3. Emergency signs shall comply with the following:

a. Refrigeration units or systems having a refrigerant circuit containing more than 220 pounds of Group A1 or 30 pounds of any other group refrigerant shall be

provided with approved emergency signs, charts, and labels in accordance with NFPA 704.

B. Per ASHRAE 15 Section 9.15: Nameplate: Each unit system and each separate condensing unit, compressor, or compressor unit sold for field assembly in a refrigerating system shall carry a nameplate marked with the manufacturer's name, nationally registered trademark or trade name, identification number, the design pressures, and the refrigerant for which it is designed by the refrigerant number (R number as shown in Table 1 or Table 2 of ASHRAE 34).

C. Per ASHRAE 15 Section 11.2.1:
11.2.1 Installation Identification: Each refrigerating system erected on the premises shall be provided with a legible permanent sign, securely attached and easily accessible, indicating (a) the name and address of the installer, (b) the refrigerant number and amount of refrigerant, (c) the lubricant identity and amount, and (d) the field test pressure applied.

D. Per ASHRAE 15 Section 11.2.2:
11.2.2 Controls and Piping Identification: Systems containing more than 110 lb (50 kg) of refrigerant shall be provided with durable signs having letters not less than 0.5 in. in height designating: (a) valves or switches for controlling the refrigerant flow, the ventilation, and the refrigeration compressor(s), and (b) the kind of refrigerant or secondary coolant contained in exposed piping outside the machinery room. Valves or piping adjacent to valves shall be identified in accordance with ANSI A13.1, Scheme for Identification of Piping Systems.

E. Per ASHRAE 15 Section 11.7:
11.7 Responsibility for Operation and Emergency Shutdown: For a refrigerating system containing more than 55 lb (25 kg) of refrigerant, provide a schematic drawing or panel giving directions for the operation of the system at a location that is convenient to the operators of the equipment. Emergency shutdown procedures, including precautions to be observed in case of a breakdown or leak, shall be displayed on a conspicuous card located as near as possible to the refrigerant compressor. These precautions shall address (a) instructions for shutting down the system in case of emergency; (b) the name, address, and day and night telephone numbers for obtaining service; and (c) the names, addresses, and telephone numbers of all corporate, local, state, and federal agencies to be contacted as required in the event of a reportable incident.

3.11 COMMISSIONING OF CHILLER PLANT EQUIPMENT

A. HVAC Contractor shall comply with the Commissioning Requirements of Contract Specifications for the entire chiller plant equipment.

B. All chilled water piping and, refrigerant piping shall be tested prior to the commencement of the commissioning process.

END OF SECTION

SECTION 237313 - AIR HANDLING UNITS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, brochures, performance charts, standard schematic drawings, specifications and installation instructions for each type of unit specified.

B. Contract Closeout Submittals:

1. Operation and Maintenance Data: Submit 2 copies to the Engineer, incorporated within maintenance manuals, covering the installed products.

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Fan ratings shall be approved by the AMCA. In lieu of an AMCA approved fan rating for the fan section of the unit, the Engineer may accept the fan manufacturer's certified rating, provided this fan manufacturer has AMCA approved ratings on his regularly manufactured centrifugal fans.

B. Source Quality Control: Factory test units in accordance with AMCA Standard 210 "Test Code for Air Moving Devices" and ARI Standard 410 "Standard for Forced Circulation Air Cooling and Air Heating Coils".

1.03 MAINTENANCE

A. Extra Materials: Provide one complete spare set of air filters with each unit, in addition to the installed operating set. Suitably box and label spare filters.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Trane Co.
McQuay
Carrier
AAON

2.02 MATERIALS

A. Sheet Metal:

1. Galvanized Sheet Steel: Zinc coated carbon steel, commercial quality-ASTM A527-67, mill phosphatized. Galvanizing: ASTM A525-67, commercial coating class 1.25 oz. per sq. ft.
2. Cold Rolled Steel: Carbon steel, commercial quality-ASTM A366-66T. Sheet steel shall be de-greased, cleaned and phosphatized in the factory of the

manufacturer, or mill phosphatized.

2.03 AIR HANDLING UNITS

A. General Design: Provide units of sectional construction each consisting of a fan section, coil section, multizone damper section, filter section, filter/mixing box section and accessories, as indicated.

B. Casing: Fabricate exterior wall panels from a minimum of No. 18 USS gage sheet steel with interior wall panels of minimum 20 gage sheet steel, properly reinforced and braced for maximum rigidity, with supporting steel framework as required. Closed cell foam gasketing shall be used where modules join. Furnish easily removable panels and inspection doors for access to all internal parts. Fabricate inspection doors from minimum No. 18 USS gage sheet steel, with the edges of all doors and removable panels formed for rigidity. Thermally insulate the casing with a factory installed, minimum 1" thick fibrous glass liner between the exterior and interior wall panel. With the exception of perforated wall panels there shall be no insulation exposed to the airstream.

C. Fan Section: Furnish fans of the double width, double inlet, forward curved, multi-blade centrifugal type, designed for low operating speeds. Fabricate fan housing utilizing lock seam construction to insure rigidity and render it mechanically airtight. Provide streamlined fan inlets, with all fan outlet areas proportioned to wheel size, according to AMCA standards. Provide shaft bearings of the grease packed ball or sleeve type, sealed in self-aligning pillow blocks. Bearings shall be equipped with grease lines allowing for lubrication from one side of the fan. Factory coat fan shaft with a corrosion preventative compound. Mount unit motor internally, complete with adjustable base, adjustable V-belt drive and an approved belt guard. Fan and motor shall be internally isolated from unit casing with spring isolators, furnished and installed by the unit manufacturer. Statically and dynamically balance and test fan assembly at factory.

D. Coil Section: Support heating coils from unit casing, as required and approved. Design coils with built-in-pitch between headers, or pitch coils inside casings to permit drainage, with connections located where indicated. Provide coils with adequate gasketing or safing to prevent air by-pass between coil channels, finned surfaces and casing. Fabricate coils of seamless copper, with aluminum flat plate fins with formed collars permanently bonded to the tubes by mechanical expansion of the tubes, or equivalent method as approved. Design encased coil banks, so as to permit the removal of any individual coil, without disturbing other coils in the bank. Coil extensions shall pass through ends of casing and shall be air and water tight. Design coils for use with steam or water for a minimum working pressure of 200 psig WSP, 200 psig OWG and factory test at 200 psig air under water.

E. Refrigerant Cooling Coil Section: Support cooling coils from unit casing, as required and approved. Provide coils with adequate gasketing or safing to prevent air by-pass between coil channels, finned surfaces and casing. Fabricate coils of seamless copper, with aluminum plate fins with formed collars permanently bonded to the tubes by mechanical expansion of the tubes, or equivalent method as approved. Design encased coil banks so as to permit the removal of any individual coil without disturbing other coils in the bank. Suction headers shall be constructed of copper tubing. Suction connections shall penetrate unit casings to permit sweat connections to refrigerate lines. The coils shall have equalizing vertical distributors sized according to the capacities of the coils. Coil performance data shall be certified in accordance with ARI Standard 410. The coils shall

be proof tested to 450 psig and leak tested to 300 psig air pressure under water. After testing, the inside of the coils shall be dried, all connections shall be sealed and the coil shall be shopped with a charge of dry nitrogen. Section shall be equipped with double-wall stainless steel condensate drain pan for positive drainage. Drain connection shall be one side of unit.

F. Cartridge Filter Section: Furnish filter sections, with filters arranged with sufficient area so that the velocity through the filters does not exceed 500 fpm, unless otherwise indicated. Design of section shall allow for the easy removal and replacement of filters. Cartridge filters shall be minimum 12" deep with efficiency rating of not less than 90 percent as determined by ASHRAE Standard 52-76. Filters shall be installed in a side access housing with seals to minimize leakage. Provide 2" pre-filters.

G. Filter / Mixing Box Section: Furnish combined air filtering and mixing functions in one standard section. Filter section shall include angled 2” pleated throwaway filters rated for 30% efficiency on ASHRAE Standard 52-76. Filters shall be accessible from both sides through hinged access doors. Mixing box shall include integral, parallel blade interconnected, outdoor and return low leakage air dampers. Dampers shall be insulated with thermally broken frame and shall have stainless steel or compressible edge seals and vinyl blade edge seals for a maximum leakage rating of 4.1 cfm per sq.ft. of face area at 4” water gauge differential static pressure. Blades shall rotate on nylon bearings; Tamco Series 9000 BF or acceptable equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units of type as indicated, in complete accordance with the manufacturer's instructions and as indicated.

B. Support:

1. Support floor-mounted units as shown in detail on the drawings. Provide vibration isolators between units and supports.

END OF SECTION 237313

SECTION 238129 - VARIABLE REFRIGERANT FLOW SYSTEM

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, brochures, performance charts, standard schematic drawings, specifications and installation instructions for each air conditioner specified.

B. Pipe sizing with shop drawings by equipment manufacture’s selection software.

C. Contract Closeout Submittals:

1. Operation and Maintenance Data: Deliver 2 copies to the Engineer, incorporated within the maintenance manual, covering equipment supplied.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Fan ratings shall be approved by AMCA. In lieu of an AMCA approved fan rating for the fan section of the unit, the Engineer may accept the fan manufacturer's certified rating, provided this fan manufacturer has AMCA approved ratings on his regularly manufactured centrifugal fans.

PART 2 - PRODUCTS

2.1 ACCEPTABLE UNIT MANUFACTURER

Trane/Mitsubishi or approved equal.

2.2 R2-SERIES HIGH EFFICIENCY (HEAT RECOVERY), AIR COOLED OUTDOOR UNITS

General:

The outdoor unit modules shall be air-cooled, direct expansion (DX), multi-zone units used specifically with VRF components described in this section and Part 5 (Controls). The outdoor unit modules shall be equipped with a single compressor which is inverter-driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.

A. Outdoor unit systems may be comprised of multiple modules with differing capacity if a brand other than basis of design is proposed. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor. Contractor responsible for ensuring alternative brand compatibility in terms of availability, physical dimensions, weight, electrical requirements, etc.

B. Outdoor unit shall have a sound rating no higher than 68 dB(A) individually or 70 dB(A) twinned. Units shall have a sound rating no higher than 52 dB(A) individually or 55 dB(A) twinned while in night mode operation. Units shall have 5 levels sound adjustment via dip switch selectable fan speed settings. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

C. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.

D. The outdoor unit shall have the capability of installing the main refrigerant piping through the bottom of the unit.

E. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. Units shall actively control liquid level in the accumulator via Linear Expansion Valves (LEV) from the heat exchanger.

F. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.

G. VRF system shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.

H. The outdoor unit shall be capable of operating in heating mode down to -25F ambient temperatures or cooling mode down to 23F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

I. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.

J. Unit must defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23F.

K. While in hot gas defrost the system shall slow the indoor unit fan speed down to maintain a high discharge air temperature, systems that keep fan running in same state shall not be allowed as they provide an uncomfortable draft to the indoor zone due to lower discharge air temperatures.

L. In reverse defrost all refrigerant shall be bypassed in the main branch controller and shall not be sent out to the indoor units, systems that flow refrigerant through indoor units during reverse defrost shall not be allowed.

M. The outdoor unit shall be capable of operating in cooling mode down to -10°F with optional manufacturer supplied low ambient kit.

1. Low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
2. Low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
3. Low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.

N. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.

O. VRF four-legged outdoor unit mounting systems shall be provided by manufacturer. Stand shall be made from 7 gauge plate steel with thermally fused polyester powder coat finish that meets ASTM D3451-06 standards. Stands shall be provided with galvanized mounting hardware and meets all ASCE 7 overturning safety requirement.

P. Unit Cabinet:

1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.
2. Outdoor unit components shall be coated with the Seacoast Protection Coating (Brine Spray – BS coating) to protect components from premature corrosion due to a seacoast environment. Coating shall be applied to components before original outdoor unit assembly to ensure manufacturer quality standards are not compromised and shall meet the following minimum requirements:
   i. ≥85µm thermoset polyester-resin powder coating on External Front Panel
   ii. ≥70µm thermoset polyester-resin powder coating on External Panel Base, Pillar, Compressor Cover, Fan Motor Support, Electrical Box
   iii. ≥1µm cellulose and polyurethane-resin coating on heat exchanger fins
   iv. ≥10µm polyurethane coating on printed circuit boards
3. The outdoor unit shall be tested in compliance with ISO9277 such that no unusual rust shall develop after 960 hours of salt spray testing.

Q. Panels on the outdoor unit shall be scratch free at system startup. If a scratch occurs the salt spray protection is compromised and the panel should be replaced immediately.

R. Fan:

1. Each outdoor unit module shall be furnished with direct drive, variable speed propeller type fan(s) only. Fans shall be factory set for operation at 0 in. WG. external static pressure, but capable of normal operation with a maximum of 0.32 in. WG. external static pressure via dipswitch.

2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.

3. All fans shall be provided with a raised guard to prevent contact with moving parts.

S. Refrigerant and Refrigerant Piping:

1. R410A refrigerant shall be required for systems.

2. Polyolester (POE) oil—widely available and used in conventional domestic systems—shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

3. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and installed in accordance with manufacturer recommendations.

4. All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.

5. Refrigerant line sizing shall be in accordance with manufacturer specifications. Future changes to indoor unit styles or sizes must be possible without resizing/replacing refrigerant piping to any other branch devices or indoor units.

T. Coil:

1. Outdoor Coil shall be constructed to provide equal airflow to all coil face surface are by means of a 4-sided coil

2. Outdoor Coil shall be elevated at least 12" from the base on the unit to protect coil from freezing and snow build up in cold climates. Manufacturer's in which their coil extends to within a few inches from the bottom of their cabinet frame shall provide an additional 12" of height to their stand or support structure to provide equal protection from elements as Mitsubishi Electric basis of design. Any additional support costs, equipment fencing, and tie downs required to meet this additional height shall be responsibility of Mechanical Contractor to provide.

3. The outdoor heat exchanger shall be of zinc coated aluminum construction with turbulating flat tube construction. The coil fins shall have a factory applied corrosion resistant finish. Uncoated aluminum coils/fins are not allowed.

4. The coil shall be protected with an integral metal guard.

5. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

6. Unit shall have prewired plugs for optional panel heaters in order to prevent any residual ice buildup from defrost. Panel heaters are recommended for operating

environments where the ambient temperature is expected to stay below -1F for 72 hours.

7. Condenser coil shall have active hot gas circuit direct from compressor discharge on lowest coil face area to shed defrost condensate away from coil and protect from Ice formation after returning to standard heat pump operation. While in Heat Pump operation this lower section of the Outdoor Evaporator coil shall continually run hot gas from the compressor discharge to protect the coil from ice buildup and coil rupture. Manufacturers who do not have an active hot gas circuit in the lower section of the Outdoor coil to protect coil from freezing shall not be allowed to bid on project in markets where the outdoor unit will see temperatures below freezing.

U. Compressor:

1. Each outdoor unit module shall be equipped with only inverter driven scroll hermetic compressors. Non inverter-driven compressors, which may cause inrush current (demand charges) and require larger generators for temporary power shall not be allowed.

2. Each compressor shall be equipped with a multi-port discharge mechanism to eliminate over compression at part load. Manufacturer's that rely on a single compressor discharge port and provide no means of eliminating over compression and energy waste at part load shall not be allowed.

3. Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. Energy-wasting "belly-band" type crankcase heaters are not allowed. Manufacturers that utilize belly-band crankcase heaters will be considered as alternate only.

4. Compressor shall have an inverter to modulate capacity. The capacity for each compressor shall be variable with a minimum turndown not greater than 15%.

5. The compressor shall be equipped with an internal thermal overload.

6. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

7. Manufacturers that utilize a compressor sump oil sensor to equalize compressor oil volume within a single module shall not be allowed unless they actively shut down the system to protect from compressor failure.

V. Controls:

1. Outdoor unit shall include Variable Evaporator Temperature or comparable method of varying system evaporator (refrigerant) temperature in order to reduce compression ratio and power consumption during light load or mild ambient temperatures. Multiple evaporator refrigerant temperature settings shall be required in order to optimize efficiency within required system-specific performance and installation constraints. System shall reduce compression ratio only when/if all indoor units are within 1.8F of setpoint; reducing compression ratio based solely on ambient temperature risks discomfort and is not allowed. Variable Evaporator Temperature or comparable method shall incorporate override or disable capability based on external signal to allow for space humidity control or load demand.The unit shall be an integral part of the system & control network described in Part 5 (Controls) and react to heating/cooling demand as communicated from connected indoor units over the control circuit.

Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.

2. Each outdoor unit module shall have the capability of 4 levels of demand control based on external input.

W. Electrical:

1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz or 460 volts, 3-phase, 60 hertz per equipment schedule.

2. The outdoor unit shall be controlled by integral microprocessors.

3. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.3 BRANCH CIRCUIT (BC) CONTROLLERS AS REQUIRED FOR SIMULTANEOUS HEAT/COOL SYSTEMS

A. General

1. BC (Branch Circuit) Controllers (or comparable branch devices) shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices which do not include controlled refrigerant subcooling risk bubbles in liquid supplied to indoor unit LEVs and are not allowed.

2. BC Controllers (or comparable branch devices) shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. BC Controllers (or comparable branch devices) shall be suitable for use in plenums in accordance with UL1995 ed 4.

3. BC Unit Cabinet:

   i. The casing shall be fabricated of galvanized steel.

   ii. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.

   iii. The unit shall house two tube-in-tube heat exchangers.

4. Refrigerant Piping (specifications in addition to those for outdoor unit):

   i. All refrigerant pipe connections shall be brazed.

   ii. Future changes to indoor unit quantities or sizes served by BC Controller or comparable branch device must be possible with no piping changes except between the branch device and indoor unit(s) changing. Systems which might require future piping changes between branch device and outdoor unit—if changes to indoor unit quantities or sizes are made—are not considered equal and are not allowed.

5. Refrigerant valves:

i. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

6. Future Use Branch:

i. Each VRF system shall include at least one (1) unused branch or branch device for future use. Future-use branches or branch devices shall be fully installed & wired in central location with capped service shutoff valve & service port.

7. Condensate Management:

i. BC Controller (or comparable branch device) must have integral resin drain pan or insulate refrigeration components with removable insulation that allows easy access for future service needs. Cabinets filled with solid foam insulation do not allow for future service and are not allowed.

8. Electrical:

i. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).

ii. The BC Controller shall be controlled by integral microprocessors

iii. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

2.3 4-WAY CEILING-RECESSED CASSETTE WITH GRILLE INDOOR UNIT

A. The ceiling-recessed indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns for different ceiling heights. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

B. Unit Cabinet:
1. The cabinet panel shall have provisions for a field installed filtered outside air intake.
2. Branch ducting shall be allowed from cabinet.
3. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.
4. The grille vane angles shall be individually adjustable from a wired remote controller to customize the airflow pattern for the conditioned space

C. Fan:
1. The indoor fan shall be an assembly with a statically and dynamically balanced turbo fan direct driven by a single motor with permanently lubricated bearings.
2. The indoor unit shall include an AUTO fan setting capable of maximizing energy efficiency by adjusting the fan speed based on the difference between controller set-point and space temperature. The indoor fan shall be capable of five (5) speed settings, Low, Mid1, Mid2, High and Auto.
3. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.

4. The indoor unit fan logic must include multiple setting that can be changed to provide optimum airflow based on ceiling height and number of outlets used.
5. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution.
6. The vanes shall have an Auto-Wave selectable option in the heating mode that shall randomly cycle the vanes up and down to evenly heat the space.
7. Grille shall include a factory-installed "3D i-see" sensor, or equal, to work in conjunction with indoor unit control sequence to prevent unnecessary cooling or heating in unoccupied areas of the zone without decreasing comfort levels. Sensor must detect occupancy (not simply motion) and location of occupants by measuring size & temperature of objects within a 39' detecting diameter (based on 8.8ft mounting height) with 1,856 or more measuring points.

D. Filter:

1. Return air shall be filtered by means of a long-life washable filter

E. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
2. The coils shall be pressure tested at the factory.
3. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

G. Controls:

1. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
2. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
3. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
4. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
5. A factory-installed drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

2.5 4-WAY CEILING-RECESSED CASSETTE WITH GRILLE FOR 2X2 GRID INDOOR UNIT

A. The indoor unit shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and

refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.

B. Unit Cabinet:
   1. The cabinet shall be a compact 22-7/16" wide x 22-7/16" deep so it will fit within a standard 24" square suspended ceiling grid.
   2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
   3. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.

C. Fan:
   1. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
   2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
   3. The indoor fan shall be capable of three (3) speed settings, Low, Mid, and High.
   4. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
   5. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution.
   6. Grille shall include an optional "3D i-see" sensor, or equal, to work in conjunction with indoor unit control sequence to prevent unnecessary cooling or heating in unoccupied areas of the zone without decreasing comfort levels. Sensor must detect occupancy (not simply motion) and location of occupants by measuring size & temperature of objects within a 39' detecting diameter (based on 8.8ft mounting height) with 1,856 or more measuring points.

D. Filter:
   1. Return air shall be filtered by means of a long-life washable filter.

E. Coil:
   1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
   2. The coils shall be pressure tested at the factory.
   3. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4" inches above the condensate pan.

F. Electrical:
   1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
   2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

G. Controls:
   1. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
   2. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
   3. Indoor unit shall include no less than four (4) digital inputs capable of being

used for customizable control strategies.

4. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
5. A factory-installed drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur, the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

2.4 CENTRAL CONTROLLER (TE-200A)

A. The Master Central Controller shall be capable of monitoring and controlling a maximum of two hundred (200) indoor units across multiple City Multi Outdoor Units with the use of three expansion modules. The controller shall be approximately 12”x8”x2.5” in size and shall be powered with an integrated 100-240 VAC power supply.

B. The Master Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. When being used alone without the expansion controllers, the Master Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a collection of indoor units (up to 50 indoor units), or all indoor units (collective batch operation).

C. All Master Centralized Controllers shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via a closed/direct Local Area Network (LAN) or to a network switch for IP communication to up to three expansion controllers for display of up to two hundred (200) indoor units on the main master centralized controller interface.

D. The Master Centralized Controller shall be capable of performing initial settings via the high-resolution, backlit, color touch panel on the controller or via a PC browser using the initial settings.

E. Connected systems and units can be monitored and operated not only from the existing web browser or the TE-200A, but also from the building management system using the BACnet communication protocol.

2.5 SPACE/ZONE CONTROLLER (TAC-YT53CRAU-J)

A. The backlit simple MA remote controller shall be capable of controlling up to 16 indoor units (defined as 1 group).

B. The backlit simple MA remote controller shall only be used in same group with wireless MA remote controllers or with other simple MA controllers, with up to two remote controllers per group.

C. Controls contractor shall be able to individually prohibit operation of each local control function for each zone from the central controller. For instance, only permit temperature adjustment within a predefined range. Other functions shall be locked out to the user.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install units of type as indicated, in complete accordance with the manufacturer's instructions

and as indicated.

B. Refrigerant pipe sizing shall be in accordance with manufactures sizing software. Contractor shall provide shop drawings to equipment manufacturer for sizing. Shop drawings shall show length of piping and anticipated fittings to allow selection software to size piping. No piping shall be provided until sizing is complete.

C. Support:

1. Support ceiling hung units from the overhead construction by means of rod type hangers, unless otherwise indicated. Support wall mounted units from structure as recommended by manufacturer.
2. Provide miscellaneous support steel as required for proper support of condensing units.

D. Install refrigeration piping in accordance with manufacturer's recommendations. Check piping for leaks and correct any deficiencies.

E. All control wiring associated with VRF systems shall be provided by the contractor.

F. All VRF and Split Systems shall connect back to the Central Controller.

END OF SECTION 238129

SECTION 238216 - COILS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Certified shop drawings for all coils not furnished as part of factory prefabricated unitized mechanical equipment.

B. Product Data: Submit manufacturer's catalog sheets, performance charts, test data, standard schematic drawings, specifications and installation instructions for each coil.

C. Quality Control Submittals:

1. Certificates: Prior to the approval of coils, the Engineer may at his option, require certified copies of coil performance and data sheets for all coils.

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Heating coils and cooling coils shall meet the applicable fabrication and testing requirements of the Safety Code for Mechanical Refrigeration ASHRAE 15. Ratings of coils, with the exception of the direct expansion refrigerant type, shall be in accordance with ARI Standard 410, "Forced Circulation Air Cooling and Air Heating Coils".
2. Published coil data, complete with sizing information, shall be available for all coils submitted for approval.

PART 2 - PRODUCT

2.01 FABRICATION AND DESIGN

A. Fabricate coils of seamless copper tubes, with aluminum flat plate fins with formed collars permanently bonded to the tubes by mechanical expansion of the tubes, or equivalent method as approved by the Engineer. Design encased coil banks, so as to permit the removal of any individual coil, without disturbing other coils in the bank. Coil extensions shall pass through ends of casing and shall be air and water tight. Design coils for use with water for a minimum working pressure of 200 psig WSP, 200 psig OWG and factory test at 250 psig air under water.

B. Select coils with the indicated number of tube rows, fin spacing, size and end connections required to meet the load requirements and other conditions indicated.

2.02 COOLING COILS

A. Refrigerant Coils: Furnish coils of the direct expansion type with a distributing header for each coil with circuiting as required, and a suction header so arranged that every tube in each circuit of the coil is supplied with an equal amount of refrigerant. Braze all coil joints. Design coils for a minimum working pressure of 480 psig and factory test at 600

psig air under water, followed by cleaning, thorough dehydration under vacuum and sealing at the factory.

2.03 CASING

A. Furnish all coils, with the exception of coils in factory packaged air handling units, with casings fabricated from a minimum of No. 16 USS gage galvanized steel, with bolting flanges on sides and ends. Securely fasten coils to casings.

2.04 COIL SUPPORTS

A. Furnish supports designed to allow for free expansional movement of the tubes. Furnish chilled water cooling coil supports fabricated from galvanized steel, with a factory applied corrosion resistant coating.

PART 3 EXECUTION

3.01 APPLICATION

A. Install coils of type and kind as indicated, in accordance with the manufacturer's instructions.

END OF SECTION 238216

SECTION 238223 - UNIT VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUBMITTALS

A. Product Data: Catalog sheets, specifications, and installation instructions for each unit ventilator.

B. Contract Closeout Submittals: Operation and Maintenance Data: Deliver two (2) copies covering the installed products to the Owner's Representative.

1.03 QUALITY ASSURANCE

A. Unit ventilators shall be tested and certified per ARI Standard 840 Unit Ventilators. Each unit ventilator shall be labeled as being tested and certified per ARI 840.

1.04 MAINTENANCE

A. Extra Material: Furnish two (2) spare sets of filters for each unit ventilator in addition to the installed operating sets making a total of four (4) sets. Box and label spare filters. Store at the site where directed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Furnish and install where shown on plans with unit characteristics as listed in schedule. The unit shall be listed by Underwriters Laboratories Inc. (U.L.) and the Canadian Standards Association (CSA). Units shall bear the U.L. and CSA labels. The unit shall be furnished with a main power "on-off" switch. Unit shall be a draw-thru design.

B. Console Cabinet Type: Cabinet shall have all welded galvanized 16 gauge furniture quality steel frame with baked enamel exterior finish. Color selected by architect from manufacturer's color chart. Top surface shall have textured baked enamel to provide superior durability, scuff resistance and low reflectivity in lieu of smooth enamel. Front access panels and top access door shall be supplied with tamper resistant hex socket head threaded fasteners. Opening or removing the unit left or right hand front panels shall not affect unit operation in order to facilitate testing and servicing. Internal sheetmetal parts shall be constructed of galvanized steel to inhibit corrosion. Unit discharge grille shall be constructed on continuous round edged steel bars to provide 10 degree vertical deflection. Adjustable side deflection vanes shall be provided beneath the discharge grille to provide optimum lateral air distribution. Cabinet depth with adaptor back shall not exceed 21 1/4" with 6” false back assembly. Provide insulated horizontal baffle to isolate horizontal

pipe chase. Provide a ¼" mesh screen shall be provided beneath the discharge grille to protect against objects being dropped through the discharge grille. Unit shall have glass fiber blanket insulation which shall act as an outdoor air seal. Units shall also have glass fiber blanket insulation on those adapter back parts which come in contact with outdoor air. Units shall have a vinyl foam air seal which shall go around the perimeter of the wall opening for the wall intake louver.

C. Fan and Motor: The motor and fan assembly shall be low speed designed to assure maximum quietness and efficiently. Fans shall be double inlet, forward curved centrifugal type with maximum fan speed of 800 RPM. Fan wheels shall be constructed of galvanized steel. Assembly shall be statically and dynamically balanced. Fan housings shall be of steel construction. Fan shaft shall be 1¼" diameter, hollow steel with 1¼" end bearing. Fan and motor assembly shall be direct drive type. Motor speed shall be controlled by factory furnished and mounted multi-tap transformer through High-Off-Low switch. Motors shall be permanent split capacitor (PSC), plug-in type designed specifically for unit ventilator operation. Motors shall be located out of the airstream and have any internal thermal overload device (auto-reset). Fan motors and controls shall have each hot line protected by factory installed cartridge type fuses(s). The unit manufacturer shall provide two (2) spare motors for each size and type of motor furnished as part of a unit ventilator, except units having double extended shaft motors shall be provided with two (2) spare fan board assemblies for each unit size. All components of the fan/motor assembly shall be removable from the front of the unit. The motor and fan shall have sleeve type bearings with precision tolerances and shall not require oiling more than once annually. Also provide a disconnect switch with thermal overload protection for all units.

D. Each unit shall be provided with return air and outdoor air dampers. The return air damper shall be constructed of steel. Outdoor air damper shall be two piece, double wall construction with ½" thick, 1.5 lbs. density fiberglass insulation sandwiched between welded 20 ga. galvanized steel blades for rigidity and to inhibit corrosion. Provide outdoor air damper shall have additional foam insulation on the exterior surfaces of the damper blade and on the ends of the outdoor air chamber. Damper actuators shall be furnished and installed by Siemens.

E. Coils: Furnish 4-pipe hot water/glycol chilled water or hot water/DX cooling coils as specified on the drawings. All coils are constructed with copper tubes and mechanically bonded aluminum corrugated plate fins. Coils shall be furnished with a threaded drain plug at the lowest point. A manual air vent shall be provided at the high point of the coil. Verify coil handing in field prior to fabrication.

F. Ceiling Units: Ceiling units shall be galvanized steel construction. Access to filters, controls and piping shall be easily available through the bottom panels. The discharge opening of the unit shall be fitted with a duct collar as shown on plans. All components of the fan/motor assembly must be removable from the bottom of the unit. The centerline of the cooling condensate drain shall be a minimum of 5" above the bottom of the unit. Furnish outside air and return air duct connect with dampers (as specified above). Outside air connection on back/top, return air connection on back/bottom as indicated. Unit shall be 16" deep max. Provide chain access panel hangers.

G. Condensate Pan: Provide an insulated drain pan shall be constructed of galvanized steel or corrosion resistant material and shall be positioned beneath the air-to-water coil. Drain connection shall be field reversible for left or right hand drain line.

H. Filter: Filter shall be one piece type. Throwaway filter shall be factory furnished initially installed in the unit. Furnish and install one set of 1" MERV 13 throw away filters prior to occupancy.

I. Wall Intake Louver: The wall intake louver shall be supplied by the unit ventilator manufacturer and installed by the building contractor. The wall intake louver shall be decorative grille type with bird screen. Louver shall be painted color as selected by Architect.

J. Accessories: Provide accessories as noted on the drawings, the products of the same manufacturer as the ventilators. Furnish accessories fabricated of the same materials and with a finish to match the ventilators. Horizontal unit ventilators shall be isolated with spring isolators.

K. Temperature Controls: Refer to Direct Digital Control System - Section 230923 or 230924. Controls to be provided by Siemens.

L. Sound data in conformance with ANSI S12.32 and ARI Standard 350 or most current industry standard.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Floor Mounted and Ceiling Mounted Units: Install, level and align units as required by the particular installation.

B. Wall Louver: Coordinate with building contractor in locating and sizing all openings. Provide complete detailed dimensional data for building contractor.

C. Provide 18 gauge sleeve from the wall intake louver to the unit ventilator. Blank-off unused portion of wall intake louver which is not required. Blank-off sections shall be insulated metal panel.

D. Accessories: Install accessories of type, quantity and in location indicated on drawing.

END OF SECTION 238223

SECTION 260009 – ELECTRICAL SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 WORK IN EXISTING BUILDINGS

A. All existing material, fixtures, and equipment that have been removed shall not be used again unless specifically required by the Drawings or Specifications.

B. Removals, Replacements, Adjustments

1. The Contractor shall remove, relocate, replace, adjust, or adapt, all existing conduit, wiring and other electric equipment or apparatus, as required, to provide a complete installation.

2. The Work shall include, providing all materials, all necessary extensions, connections, cuttings, repairing, adapting and other Work incidental thereto, together with such temporary connections as may be required to maintain service pending the completion of the permanent Work. All Work shall be left in good working order and in a condition equal to the adjacent new or existing Work.

C. Care in Removing Existing Conductors

1. The Contractor shall use due care and diligence in removing existing conductors from existing conduits to prevent conductors from breaking and becoming an irretrievable obstruction within the conduits.

D. Cutting and Repairing

1. Whenever the cutting, or drilling, or removal of any part of the structure (ceilings, walls, floors, shelving, bookcases, partitions, etc.), is required to remove, relocate, alter or install any article of electrical equipment (including conduits, boxes, fittings, etc.), the Contractor shall perform all cutting, drilling, etc., and remove the section of structure required. After removal and installation of the electric equipment, the Contractor shall repair the section of structure, as directed by the Schools, Architect and contract documents, with new materials, equal to that of adjacent structure of the same type.

   Note that in general, all holes through existing structures for conduit installation shall be core drilled, unless prior written approval is provided by the School.

   Contractor shall use extreme care when core drilling to avoid damaging the existing infrastructure.

2. Whenever holes are cut in fire-rated walls or floor slabs to permit the installation of conduit or electrical equipment, these holes shall be repaired with material that will restore the fire rating of the wall or floor slab to its original condition.

3. The Contractor shall paint all repaired areas of the building. The paint shall match the paint of adjacent surface areas, or extend to the nearest architectural break-line, as directed.

4. Wherever any part of the structure is marred or damaged, the Contractor shall repair the damaged or marred areas of the structure.

5. Where a piece of electrical equipment is removed, the Contractor shall finish that part of the surface to match surroundings.

E. Damaged Apparatus: Should any damage, due to the execution of this Contract, occur to the furniture, fixtures, or any equipment or apparatus, such damage shall be properly repaired and/or replaced by the Contractor without charge.

F. Non-Interruption of Services

1. It is imperative that all existing services (electric, light, power, fire alarm, telecommunications, etc.) be always kept in operation, unless prior written approval is received from the Authority.

2. Provide fire watch services, as necessary, during disruption of fire alarm system.

1.2 TESTS

A. The Contractor shall demonstrate to the Authority operation of all equipment and systems. All tests shall be completed to the satisfaction of the Authority. Each test shall be performed as indicated in the individual specification section.

1.3 CLEANING AND REPAIR

A. On completion of installation, inspect interior and exterior of installed equipment. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

B. Contractor shall not leave sharp exposed metal edges (bottom of threaded rods, electrical equipment supports, etc.) that could otherwise present safety hazards to the building's occupants/work staff.

SECTION 260010 - SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supplemental requirements applicable to Work specified in Division 26.

B. Related Requirements:

1. Section 01 00 00 “General requirements" for coordination, shop drawings, installation, testing, and inspection requirements.

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. AFCI: Arc-fault circuit interrupter.
4. AIC: Ampere interrupting capacity.
5. AL, Al, or ALUM: Aluminum.
6. ASD: Adjustable-speed drive.
7. ATS: Automatic transfer switch.
8. AWG: American wire gauge; see ASTM B258.
9. BAS: Building automation system.
10. BIL: Basic impulse insulation level.
11. BIM: Building information modeling.
12. CAD: Computer-aided design or drafting.
13. CB: Circuit breaker.
14. CO/ALR: Copper-aluminum, revised.
15. CU or Cu: Copper.
16. CU-AL or AL-CU: Copper-aluminum.
17. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
18. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
19. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
20. dBm: Decibel absolute power with respect to 1 mW.
21. DC or dc: Direct current.
22. DCOA: Designated critical operations area.
23. DDC: Direct digital control (HVAC).
24. EGC: Equipment grounding conductor.
25. EMF: Electromotive force.

26. EMI: Electromagnetic interference.
27. EPM: Electrical preventive maintenance.
28. EPS: Emergency power supply.
29. EPSS: Emergency power supply system.
30. ESS: Energy storage system.
31. fc: Footcandle, a unit of illuminance equal to one lumen per square foot.
32. FLC: Full-load current.
33. ft.: Foot.
34. GEC: Grounding electrode conductor.
35. GFCI: Ground-fault circuit interrupter.
36. GFPE: Ground-fault protection of equipment.
37. GND: Ground.
38. HACR: Heating, air conditioning, and refrigeration.
39. HDPE: High-density polyethylene.
40. HID: High-intensity discharge.
41. HP or hp: Horsepower.
42. HVAC: Heating, ventilating, and air conditioning.
43. Hz: Hertz.
44. IBT: Intersystem bonding termination.
45. inch: Inch. To avoid confusion, the abbreviation "in." is not used.
46. IP: Ingress protection rating (enclosures); Internet protocol (communications).
47. IR: Infrared.
48. IS: Intrinsically safe.
49. IT&R: Inspecting, testing, and repair.
50. ITE: Information technology equipment.
51. kAIC: Kiloampere interrupting capacity.
52. kcmil or MCM: One thousand circular mils.
53. kV: Kilovolt.
54. kVA: Kilovolt-ampere.
55. kVAr or kVAR: Kilovolt-ampere reactive.
56. kW: Kilowatt.
57. kWh: Kilowatt-hour.
58. LAN: Local area network.
59. lb: Pound (weight).
60. LCD: Liquid-crystal display.
61. LCDI: Leakage-current detector-interrupter.
62. LED: Light-emitting diode.
63. LRC: Locked-rotor current.
64. MCC: Motor-control center.
65. MG set: Motor-generator set.
66. MLO: Main lugs only.
67. MVA: Megavolt-ampere.
68. mW: Milliwatt.
69. MW: Megawatt.
70. MWh: Megawatt-hour.
71. NC: Normally closed.
72. NiCd: Nickel cadmium.
73. NIU: Network interface unit.
74. NO: Normally open.
75. NPT: National (American) standard pipe taper.
76. OCPD: Overcurrent protective device.

77. PCS: Power conversion system.
78. PCU: Power-conditioning unit.
79. PF or pf: Power factor.
80. PoE: Power over Ethernet.
81. PV: Photovoltaic.
82. PVC: Polyvinyl chloride.
83. pW: Picowatt.
84. RFI: Radio-frequency interference (electrical); Request for interpretation (contract).
85. RMS or rms: Root-mean-square.
86. RPM or rpm: Revolutions per minute.
87. SCADA: Supervisory control and data acquisition.
88. SCR: Silicon-controlled rectifier.
89. SPD: Surge protective device.
90. sq.: Square.
91. SWD: Switching duty.
92. TCP/IP: Transmission control protocol/Internet protocol.
93. TEFC: Totally enclosed fan-cooled.
94. TR: Tamper resistant.
95. TVSS: Transient voltage surge suppressor.
96. UL: Underwriters Laboratories, Inc. (standards) or UL LLC (services).
97. UL CCN: UL Category Control Number.
98. UPS: Uninterruptible power supply.
99. USB: Universal serial bus.
100. UV: Ultraviolet.
101. V: Volt, unit of electromotive force.
102. V(ac): Volt, alternating current.
103. V(dc): Volt, direct current.
104. VA: Volt-ampere, unit of complex electrical power.
105. VAr: Volt-ampere reactive, unit of reactive electrical power.
106. VFC: Variable-frequency controller.
107. VOM: Volt-ohm-multimeter.
108. VPN: Virtual private network.
109. W: Watt, unit of real electrical power.
110. Wh: Watt-hour, unit of electrical energy usage.
111. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Raceway Types:

1. EMT: Electrical metallic tubing.
2. EMT-A: Aluminum electrical metallic tubing.
3. EMT-S: Steel electrical metallic tubing.
4. EMT-SS: Stainless steel electrical metallic tubing.
5. ENT: Electrical nonmetallic tubing.
6. EPEC: Electrical HDPE underground conduit.
7. EPEC-40: Schedule 40 electrical HDPE underground conduit.
8. EPEC-80: Schedule 80 electrical HDPE underground conduit.
9. EPEC-A: Type A electrical HDPE underground conduit.
10. EPEC-B: Type B electrical HDPE underground conduit.
11. ERMC: Electrical rigid metal conduit.
12. ERMC-A: Aluminum electrical rigid metal conduit.
13. ERMC-S: Steel electrical rigid metal conduit.

14. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.
15. ERMC-S-PVC: PVC-coated-steel electrical rigid metal conduit.
16. ERMC-SS: Stainless steel electrical rigid metal conduit.
17. FMC: Flexible metal conduit.
18. FMC-A: Aluminum flexible metal conduit.
19. FMC-S: Steel flexible metal conduit.
20. FMT: Steel flexible metallic tubing.
21. FNMC: Flexible nonmetallic conduit. See LFNC.
22. HDPE: See EPEC.
23. IMC: Steel electrical intermediate metal conduit.
24. LFMC: Liquidtight flexible metal conduit.
25. LFMC-A: Aluminum liquidtight flexible metal conduit.
26. LFMC-S: Steel liquidtight flexible metal conduit.
27. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
28. LFNC: Liquidtight flexible nonmetallic conduit.
29. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
30. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
31. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
32. PVC: Rigid PVC conduit.
33. PVC-40: Schedule 40 rigid PVC conduit.
34. PVC-80: Schedule 80 rigid PVC Conduit.
35. PVC-A: Type A rigid PVC concrete-encased conduit.
36. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
37. RGS: See ERMC-S-G.
38. RMC: See ERMC.
39. RTRC: Reinforced thermosetting resin conduit.
40. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
41. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
42. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
43. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
44. RTRC-BG: Low-halogen, belowground 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. Concrete Box: A box intended for use in poured concrete.
    c. 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.
    d. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
    e. 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.
    f. Device Box: A box with provisions for mounting a wiring device directly to the box.
    g. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
    h. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
    i. 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.
    j. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.

k. 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.
l. 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.
m. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
n. 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.
o. Raised-Floor Box: A floor box intended for use in raised floors.
p. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.
q. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
r. 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.
s. 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.
t. 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. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.
9. Jacket: A continuous nonmetallic outer covering for conductors or cables.
10. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.
11. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the Energy Independence and Security Act (EISA) of 2007.
12. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
13. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
14. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
15. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
16. Sheath: A continuous metallic covering for conductors or cables.
17. UL Category Control Number: An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.

18. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
    a. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by Class 2 or Class 3 power supplies having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
    b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation, in contrast to control-voltage devices that require or contain transformer power supplies. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
    c. Low Voltage: Listed and labeled for use in circuits supplied by Class 1 or other power supplies having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.
    d. Medium Voltage: Listed and labeled for use in circuits supplied by a power supply having rated output greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Parts I and II.

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 Owner no fewer than seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.
3. Coordinate interruption with systems impacted by outage including, but not limited to, the following:
    a. Exercising generators.
    b. Emergency lighting.
    c. Elevators.
    d. Fire-alarm systems.

1.4 SEQUENCING

A. Conduct and submit results of power system studies, short circuit study and arc flash Hazard analysis before submitting Product Data and Shop Drawings for electrical equipment.

1.5 SCHEDULING

A. Coordinate with school for scheduling .

1.6 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, 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. Structural members to which equipment and suspension systems will be attached.
3. Size and location of access panels on ceilings.
4. Elevation, size, and route of sprinkler piping.
5. Elevation, size, and route of plumbing piping.
6. Elevation, size, and route of ductwork.
7. Elevation, size, and route of cable tray.
8. Elevation, size, and route of conduit.
9. Elevation and size of wall-mounted and ceiling-mounted equipment.
10. Access panels.
11. Sprinklers.
12. Air inlets and outlets.
13. Control modules.
14. Luminaires.
15. Communications devices.
16. Speakers.
17. Security devices.
18. Fire-alarm devices.
19. Indicate clear dimensions for maintenance access in front of equipment.
20. Indicate dimensions of fully-open access doors.

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.

C. Coordination Drawings for Large Equipment Outdoor Installations:

1. Utilities site plan, drawn to scale, showing heavy equipment or truck access paths for maintenance and replacement, with the following items shown and coordinated with each other, based on input from installers of the items involved:
   a. Fences and walls, dimensioned concrete bases, outlines of equipment, conduit entries, and grounding and bonding locations.
   b. Indicate clear dimensions for fence gates and wall openings.
   c. Indicate depth and type of ground cover, and locations of trees, shrubbery, and other obstructions in access path.
   d. Indicate clear height below tree branches, overhead lines, bridges, and other overhead obstructions in access path, or where cranes and hoists will be needed to handle large electrical equipment.
   e. Support locations, type of support, and weight on each support. Locate structural supports for structure-supported raceways .
   f. Dimensioned working clearances and dedicated areas around electrical equipment.

D. Coordination Drawings for Electrical service room and ATS rooms:

1. Provide coordination drawing to show all the electrical equipment in large scale plan and elevation including wire trough, conduits along with all the code required clearances between equipment and walls for code compliance installation and review by EOR.

1.7 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 power system studies.
2. Submission of ARC-Flash Hazard Analysis.
3. Submission of specified coordination drawings.
4. Submission of action submittals specified in Division 26.
5. Orders placed for major electrical equipment.
6. Arrival of major electrical equipment on-site.
7. Preinstallation meetings specified in Division 26.
8. Utility service outages.
9. Utility service inspection and activation.
10. Mockup reviews.
11. Closing of walls and ceilings containing electrical Work.
12. System startup, testing, and commissioning activities for major electrical equipment.
13. System startup, testing, and commissioning activities for emergency lighting.
14. System startup, testing, and commissioning activities for automation systems (BMS, lighting, Emergency generator, HVAC, fire alarm, fire pump, etc.).
15. Pouring of concrete housekeeping pads for electrical equipment and testing of concrete samples.
16. Requests for special inspections.
17. Requests for inspections by authorities having jurisdiction.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide emergency, operation, and maintenance manuals for each system, equipment, and device listed below:
   a. Transformer, Panel board, switchboard, Fusible Interrupting switch and Lighting control, etc. .
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. Exterior pole inspection and repair procedures.

B. Software and Firmware Operational Documentation: Provide software and firmware operational documentation in Facility EPM Program Binders, including the following:

1. Software operating and upgrade manuals.
2. Names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.
5. Testing and adjusting of panic and emergency power features.
6. For lighting controls include the following:
   a. Adjustments of scene preset controls, adjustable fade rates, and fade overrides.
   b. Operation of adjustable zone controls.

C. Software:

1. Program Software Backup: Provide username and password for approved online or cloud solution .

1.1 MOCKUPS

A. Simple Mockups for Coordinating Accessibility of Electrical Devices around Fixed Furnishings and Equipment:

1. Build simple mockups using art supplies and other inexpensive materials for verification of general arrangement, actual dimensions, and accessibility of rooms selected by Architect prior to fabrication and installation of Work. Depict products from all Divisions requiring coordination including, but not limited to, fixed furnishings, casework, outlet covers and plates, HVAC controls, exposed raceway, exposed plumbing, equipment, and signage.

B. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.2 FIELD CONDITIONS

A. Modeling, analysis, product selection, installation, and quality control for Work specified in Division 26 must be complied.

PART 2 - EXECUTION

2.1 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.

2.2 SYSTEM STARTUP

A. Commissioning Activities:

1. Provide commissioning of lighting control system

2.3 FIELD QUALITY CONTROL

A. Administrant for Low-Voltage Electrical Tests and Inspections:

1. Engage qualified testing and inspecting agency to administer and perform tests and inspections.
2. Administer and perform tests and inspections.

B. Administrant for Control-Voltage Electrical Tests and Inspections:

1. Engage qualified control-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
2. Administer and perform tests and inspections.

C. Administrant for Field Tests and Inspections of Lighting Installations:

1. Engage qualified lighting testing and inspecting agency to administer and perform tests and inspections.
2. Administer and perform tests and inspections.

PART 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 "Lighting Control Devices."
   b. Lighting control systems specified in Section 260943 "Relay Based Lighting Controls."
   c. All other items specified in individual specification sections under division 26.

2. Provide video recordings of demonstrations to Owner.

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 "Lighting Control Devices."
   b. How to adjust, operate, and maintain hardware and software specified in Section 260943 "Relay-Based Lighting Controls."
   c. How to adjust, operate, and maintain control modules specified in Section 262416 "Electronically Operated Circuit-Breaker Panelboards."
   d. How to adjust, operate, and maintain equipment specified in Section 262913 "Manual and Magnetic Motor Controllers."
   e. How to adjust, operate, and maintain luminaires specified in Section 265119 "LED Interior Lighting."
   f. How to adjust, operate, and maintain luminaires and photoelectric controls specified in Section 265619 "LED Exterior Lighting."
   g. How to adjust, operate, and maintain Exit signs specified in Section 265213 "EXIT Lighting."

2. Provide video recordings of training sessions to Owner.

END OF SECTION 260010

SECTION 260513 - MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cables.
2. Connectors.
3. Solid terminations.
4. Separable insulated connectors.
5. Splice kits.
6. Medium-voltage tapes.
7. Arc-proofing materials.
8. Fault indicators.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Indicate location of each cable, splice, and termination.

B. Material Certificates: For each type of cable and accessory.

C. Design Data: Cable pulling calculations, including conduit size and fill percentage, pulling tensions, cable sidewall pressure, jam probability, voltage drop, and ground wire sizing for each cable.

D. Source quality-control reports.

E. Field quality-control reports.

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 IEEE C2 and NFPA 70.

C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General Cable; Prysmian Group North America.
2. Okonite Company (The).
3. Southwire Company, LLC.

B. Cable Type: Type MV 105.

C. Conductor Insulation: Ethylene-propylene rubber.

1. Voltage Rating: 15 or 25 kV. As applicable to site specifics.
2. Insulation Thickness: 133 percent insulation level.

D. Conductor: Copper.

E. Comply with UL 1072, AEIC CS8, ICEA S-93-639/NEMA WC 74, and ICEA S-97-682.

F. Conductor Stranding: Concentric lay, Class B.

G. Shielding: Copper tape, helically applied over semiconducting insulation shield.

H. Shielding and Jacket: Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.

I. Cable Jacket: Sunlight-resistant PVC.

2.3 CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. ABB, Electrification Business.
3. Eaton.

B. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.

C. Copper-Conductor Connectors: Copper barrel crimped connectors.

2.4 SOLID TERMINATIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. ABB, Electrification Business.
3. TE Connectivity Ltd.

B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.

1. Class 1 Terminations:

a. Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.
b. Heat-shrink type with heat-shrink inner stress control and outer nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.

2.5 SEPARABLE INSULATED CONNECTORS

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.
2. Eaton.

C. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

D. Load-Break Cable Terminators: Elbow-type units with 200 A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

E. Dead-Break Cable Terminators: Elbow-type unit with 600 A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

F. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless steel mounting brackets, and attaching hardware.

1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.

4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

G. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.6 SPLICE KITS

A. Description: For connecting medium voltage cables; type as recommended by cable or splicing kit manufacturer for the application.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
1. ABB, Electrification Business.
2. Eaton.

C. Standard: Comply with IEEE 404.

D. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.

1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
2. Premolded, cold-shrink-rubber, in-line splicing kit.
3. Premolded, EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.
4. Separable multiway splice system with all components for the required splice configuration.

2.7 MEDIUM-VOLTAGE TAPES

A. Description: Electrical grade, insulating tape rated for medium voltage application.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. HellermannTyton.
3. Scapa Industrial; Scapa Group plc.

C. Ethylene/propylene rubber-based, 30 mil (0.76 mm) splicing tape, rated for 130 degC operation. Minimum 3/4 inch (20 mm) wide.

2.8 ARC-PROOFING MATERIALS

A. Description: Fire retardant, providing arc flash protection.

B. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. 3M.

C. Tape for First Course on Metal Objects: 10 mil (250 micrometer) thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.

D. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, and compatible with cable jacket.

E. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch (25 mm) wide.

2.9 SOURCE QUALITY CONTROL

A. Test and inspect cables according to ICEA S-97-682 before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inch (1200 to 1800 mm) on the pull rope.

1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.

D. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.

E. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.

F. Install cable splices at pull points and elsewhere as indicated; use standard kits. Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.

G. Install terminations at ends of conductors, and seal multiconductor cable ends with standard kits.

H. Install separable insulated-connector components as follows:

1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
3. Standoff Insulator: At each terminal junction, with one on each terminal.

I. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Clean cable sheath.
2. Wrap metallic cable components with 10 mil (250 micrometer) pipe-wrapping tape.
3. Smooth surface contours with electrical insulation putty.
4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
5. Band arc-proofing tape with two layers of 1 inch (25 mm) wide half-lapped, adhesive, glass-cloth tape at each end of the arc-prooftape.

J. Ground shields of shielded cable at one point only. Maintain shield continuity and connections to metal connection hardware at all connection points.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.
4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.

B. Medium-voltage cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 260513

SECTION 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Fire-alarm wire and cable.
4. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260010 "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.

B. Sustainable Design Submittals:

1. Product Data: For each conductor and cable indicating lead content.
2. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.
3. Product Data: For solvents and adhesives, indicating VOC content.
4. Laboratory Test Reports: For solvents and adhesives, indicating compliance with requirements for low-emitting materials.

C. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Insulated Cable in Raceways:

1. Material: Single conductor copper cable conforming to ASTM B8 with abrasion resistant, moisture and heat resistant polyvinyl chloride insulated, nylon jacketed rated 90C in dry locations and 90C in wet locations. Cable shall be listed by UL as Type THWN-2. All underground raceways for power wiring shall be wired using extra heavy cross-linked polyethylene wire insulation, rated type USE-2/rhw-2.

2. Where cable is designated as multiconductor on the Drawings (10/c for example), the conductors shall have an overall PVC jacket.

3. Wire Sizes: Not smaller than No. 12 AWG for power and lighting and No. 14 AWG for control.

4. Stranding: All 600-volt cable shall be stranded.

5. Product and Manufacturer: Provide material manufactured by one of the following:

a. Alpha Wire Company...

b. American Bare Conductor.

c. Southwire Company

d. Or approved equal.

C. Cable Connectors, Splices and Terminals, Solderless Type:

For stranded wire sizes up to #6 AWG, use compression type.

1. Product and Manufacturer: Provide one of the following:

a) Sta-Kon.

b) Burndy Hylug.

c) Or approved equal.

2. For sizes #4 AWG and above, use either compression type or bolted type with silver plated contact faces.

3. For sizes #250 MCM and larger, use connectors and terminals with at least 2 cable clamping elements or compression indents and provision for at least 2 bolts for joining to apparatus terminal.

D. Cable Markers: Product and Manufacturer: Provide one of the following:

1. Omni-Grip by W.H. Brady Company.

2. Or approved equal.

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. Alpha Wire Company.
2. American Bare Conductor.
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. Comply with UL 1569.
3. 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 .
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.
3. Type USE/RHW for wet and dry location
4. Type MI for emergency as indicated in dwg.

H. Armor: Steel, 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. Vent (PYROTENAX).
4. Prysmian Cables and Systems; Prysmian Group North America.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

1. Lead Content: Less than 300 parts per million.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 14 AWG.

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. 14 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
3. Multiconductor Armored Cable: NFPA 70, plenum rated red colored jacket metal clad Type MC-FPLP AND MC-FPLR, copper conductors, cables for recessed installation only.

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. ABB, Electrification Products Division.
3. Hubbell Incorporated, Power Systems.

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 Two hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; stranded for all sizes

B. Branch Circuits:

1. Copper; stranded for all sizes
2. Power-Limited Fire Alarm and Control: Copper; stranded for all sizes

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway Type XHHW-2, single conductors in conduit.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in conduit.

C. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway, Metal-clad cable, Type MC- except for homerun circuits to an electrical panelboard.

E. Raceway from the electrical panelboard shall be provided to a junction box located above the ceiling in the area that the branch circuit serves. Metal-clad cable may be used from this junction box for lighting fixtures, lighting control devices, general use receptacles and for other similar 20A branch circuits.

1.1 INSTALLATION OF CONDUCTORS AND CABLES

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."

1.2 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NFPA 72.

B. Wiring Method: Install wiring in metal pathway.

1. Install plenum rated red colored jacket metal clad cable type MC-FPLP and MC-FPLR in all recessed installation in ceiling and wall.
2. Install 2-hour fire rated fire alarm cable in galvanized ¾” steel conduit in the following locations:
   a. Where subject to physical damage by normal building use.
   b. All exposed exterior installation, mechanical room, electrical room, elevator hoist way, and elevator machine room.
   c. All exposed conduit installation below 96” AFF
   d. Passing through a floor or wall.
   e. All other locations as indicated in NFPA 70 and 72.

3. All exposed interior installation other than the location indicated in item # B(2) above shall be installed in minimum ¾” EMT conduit.
4. Fire alarm cable that is not metal clad or not installed in race way is not permitted.
5. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must 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.

6. Signaling Line Circuits: Power-limited fire-alarm cables must not 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.

1.3 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 and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

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 inch of slack.

D. Comply with requirements in Section 284621 "Addressable Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.

1.4 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.

1.5 TESTING

A. Test each electrical circuit after permanent cables are in place to demonstrate that the circuit and connected equipment perform satisfactorily and that they are free from improper grounds and short circuits.

B. Individually test 600-volt cables for insulation resistance between phases and from each phase to ground. Test after cables are installed and before they are put in service with a 1000 volt Megger whose rating is suitable for the tested circuit. Tests shall meet with the applicable specifications of ICEA S-95658/NEMA WC70.

C. The insulation resistance for any given conductor shall not be less than the value recommended by the ICEA or a minimum of I megohm for 600-volt and less service, if not ICEA listed. Any cable not meeting the recommended value, or which fails when tested under full load conditions shall be replaced with a new cable for the full length. Furnish the authority with a copy of the "Megger" test report for EOR's review and approval.

1.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior wall, floor and rated wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

1.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating.

END OF SECTION 260519

SECTION 260526 - 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 260010 "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.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: In addition to items specified in Section 260010 "Supplemental Requirements for Electrical," include the following:

1. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
   a. Test wells.
   b. Ground rods.
   c. Grounding arrangements and connections for separately derived systems.
   d. Ground Bus .
2. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B .
   a. Tests must determine if ground-resistance or impedance values remain within specified maximums, and instructions must recommend corrective action if values do not.
   b. Include recommended testing intervals.

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. ERICO; nVent.
3. 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. Use green color insulated copper conductor for equipment grounding.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
4. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Isolated Ground Conductors: Insulated with green-colored simulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

E. Grounding Electrode Conductors: Stranded cable.

F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

G. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

H. Grounding Bus:

1. Predrilled rectangular bars of annealed copper, 1/4 by 4 inch cross section, with 9/32-inch holes spaced 1-1/8 inch apart. Stand-off insulators for mounting must comply with UL 891 for use in switchboards, 600 V and must be Lexan or PVC, impulse tested at 5000 V.

2. Ground clamp on the main water pipe is to be listed for the application and compatible with the water pipe material, so as to prevent corrosion.

3. Conductor connecting bus bar to the main water pipe to be sized and installed as per electrical code.

4. Grounding conductors' conduits to be connected to the grounding bus as per electrical code.

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. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Mechanical-Type Bus-Bar Connectors: Cast silicon bronze, solderless compression exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Compression-Type Bus-Bar Connectors: Copper or copper alloy, with two wire terminals.

E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with [hex head bolt] [socket set screw].

J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

K. Lay-in Lug Connector: Mechanical type,

L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

N. Straps: Solid copper, cast-bronze clamp . Rated for 600 A.

O. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.

P. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

Q. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated bolts.
   a. Material: Die-cast zinc alloy.
   b. Listed for direct burial.
2. U-bolt type with malleable-iron clamp and copper ground connector.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel ; 3/4 inch by 10 ft. .

B. Ground Plates: 1/4 inch thick, hot-dip galvanized.

C. Underground metal water piping.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 30 inch below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, telecom room, AV equipment room and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inch minimum from wall, 6 inch above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors must be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including dampers, humidifiers, etc. Bond conductor to each unit and to air duct.

C. Water Heater Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.5 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. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inch below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
2. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

F. Grounding of Cable Tray: Install insulated copper grounding conductors and ground each section of cable tray and connect to building grounding system.

3.6 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.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal , at ground test wells . Make tests at ground rods before any conductors are connected.
    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, the contractor is responsible to reduce ground resistance as recommended by national electric codes and notify Architect promptly.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

B. Provide supporting devices and accessories required for a complete system and its proper operation.

C. Related Requirements:

1. Section 260010 "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.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers and supports.

1.3 INFORMATIONAL SUBMITTALS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified structural professional engineer to design hanger and support system.

2.2 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.
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-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Galvanized 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.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless 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) Hilti, Inc.
      2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      3) 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: Stainless steel springhead type.

7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 SELECTION

A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA NEIS 101
2. NECA NEIS 102.
3. NECA NEIS 105.
4. NECA NEIS 111.

B. Comply with requirements for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as required by NFPA 70. Minimum rod size must be 1/4 inch in diameter.

E. 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 .

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 INSTALLATION OF SUPPORTS

A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT may be supported by openings through structure members, in accordance with NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To New Concrete: Bolt to concrete inserts.
2. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inch thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inch thick.
3. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 Spring-tension clamps.

E. 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. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type EMT-SS raceways and elbows.
2. Type EMT-S raceways and elbows.
3. Type ENT raceways and fittings.
4. Type ERMC-SS raceways, elbows, couplings, and nipples.
5. Type ERMC-S raceways, elbows, couplings, and nipples.
6. Type FMC-S raceways.
7. Type IMC raceways.
8. Type LFMC raceways.
9. Type PVC raceways and fittings.
10. Fittings for conduit, tubing, and cable.
11. Threaded metal joint compound.
12. Solvent cements.
13. In Carpet Connectrac Powered Wireway-3.7” wide.
14. Stainless Steel Steelcase thread-floor infeeds-single/dual circuit and components
15. Metallic outlet boxes, device boxes, and covers.
16. Termination boxes.
17. Cabinets, cutout boxes, junction boxes, and pull boxes.
18. Cover plates for device boxes.
19. Hoods for outlet boxes.

B. Provide raceways, fittings, supporting devices, boxes and accessories required for a complete system and its proper operation.

C. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, floor furnitures, HVAC equipment, fire-suppression system, and partition assemblies.

D. Related Requirements:

1. Section 260010 "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 the following:

1. Wireways and auxiliary gutters.

2. In Carpet Connectrac Powered Wireway-3.7" wide.
3. Stainless Steel Steelcase thread-floor infeeds-single/dual circuit and components
4. Floor boxes/hubs.
5. Cabinets and cutout boxes.

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. Indicate floor thickness where boxes are embedded in concrete floors and underfloor clearances where boxes are installed in raised floors.

C. Samples: For wireways , surface raceways, and floor boxes for colors and textures specified.

PART 2 - PRODUCTS

2.1 TYPE EMT-SS RACEWAYS AND ELBOWS

A. Stainless Steel Electrical Metal Tubing (EMT-SS) and Elbows:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Allied Tube & Conduit; Atkore International.
   b. Calconduit; Atkore International.
   c. Emerson Electric Co.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 797A and UL Category Control Number FJMX.
      2) Material: Stainless steel.
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
      2) Colors: As indicated on Drawings.

2.2 TYPE EMT-S RACEWAYS AND ELBOWS

A. Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Allied Tube & Conduit; Atkore International.
   b. Calconduit; Atkore International.
   c. Emerson Electric Co.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 797 and UL Category Control Number FJMX.
      2) Material: Steel.
      3) Exterior Coating: Alternate corrosion-resistant coating.
      4) Interior Coating: Zinc .

c. Options:
1) Minimum Trade Size: 3/4 inch .
2) Colors: As indicated on Drawings.

2.3 TYPE ENT RACEWAYS AND FITTINGS

A. Electrical Nonmetallic Tubing (ENT) and Fittings (for use in underground installation outside of building footprint only):

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Cantex Inc.
   c. JM Eagle; J-M Manufacturing Co., Inc.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 1653 and UL Category Control Number FKHU.
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
   d. Fittings:
      1) Mechanically Attached Fittings: UL 1653.
      2) Solvent-Attached Fittings: UL 651.

2.4 TYPE ERMC-SS RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Stainless Steel Electrical Rigid Metal Conduit (ERMC-SS), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Allied Tube & Conduit; Atkore International.
   c. Calconduit; Atkore International.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 6A and UL Category Control Number DYWV.
      2) Material: Stainless steel.
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
      2) Colors: As indicated on Drawings.

2.5 TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, undefined:

a. Allied Tube & Conduit; Atkore International.
b. Calconduit; Atkore International.
c. Crouse-Hinds; Eaton, Electrical Sector.

2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 6 and UL Category Control Number DYIX.
      2) Exterior Coating: Zinc.
      3) Interior Coating: Zinc .
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
      2) Colors: As indicated on Drawings.

B. PVC-Coated-Steel Electrical Rigid Metal Conduit (ERMC-S-PVC), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Bluesteel Services LLC.
   c. Calbond; Atkore International.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 6 and UL Category Control Number DYIX.
      2) Exterior Coating: PVC complying with NEMA RN 1.
      3) Interior Coating: Zinc .
      4) Fittings for PVC-Coated Conduit:
         a) Minimum coating thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
         b) Conduit bodies must be Form 8 with an effective seal and a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours must be available. Conduit bodies must be supplied with plastic-encapsulated stainless steel cover screws.
         c) Form 2 inch long or one pipe diameter long, whichever is less, PVC sleeve at openings of female fittings, except unions. Inside sleeve diameter must be matched to outside diameter of metal conduit.
         d) PVC coating on the outside of conduit couplings must be protected from tool damage during installation.
         e) Female threads on fittings and couplings must be protected by urethane coating.
         f) Fittings must be from same manufacturer as conduit.
         g) Beam clamps and U bolts must be formed and sized to fit outside diameter of coated conduit. Plastic-encapsulated nuts must cover the exposed portions of threads.
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
      2) Colors: As indicated on Drawings.

3) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
4) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.6 TYPE FMC-S RACEWAYS

A. Steel Flexible Metal Conduit (FMC-S):

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Electri-Flex Company.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standard: UL 1 and UL Category Control Number DXUZ.
      2) Material: Steel.
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
      2) Colors: As indicated on Drawings.

2.7 TYPE IMC RACEWAYS

A. Steel Electrical Intermediate Metal Conduit (IMC):

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Allied Tube & Conduit; Atkore International.
   c. Calconduit; Atkore International.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standard: UL 1242 and UL Category Control Number DYBY.
      2) Exterior Coating: Alternative corrosion-resistant coating.
      3) Interior Coating: Zinc .
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
      2) Colors: As indicated on Drawings.

2.8 TYPE LFMC RACEWAYS

A. Steel Liquidtight Flexible Metal Conduit (LFMC-S):

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Anaconda Sealtite; Anamet Electrical, Inc.
   c. Electri-Flex Company.

2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standard: UL 360 and UL Category Control Number DXHR.
      2) Material: Steel.
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
3. Colors: As indicated on Drawings.

B. Stainless Steel Liquidtight Flexible Metal Conduit (LFMC-SS):

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Electri-Flex Company.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standard: UL 360 and UL Category Control Number DXHR.
      2) Material: Stainless steel.
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
3. Colors: As indicated on Drawings.

2.9 TYPE PVC RACEWAYS AND FITTINGS (for use in underground installation outside of building footprint only):

A. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Calconduit; Atkore International.
   c. JM Eagle; J-M Manufacturing Co., Inc.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 651 and UL Category Control Number DZYR.
      2) Dimensional Specifications: Schedule 40.
   c. Options:
      1) Minimum Trade Size: 3/4 inch .
      2) Markings: For directional boring applications.

B. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Calconduit; Atkore International.
   c. JM Eagle; J-M Manufacturing Co., Inc.
2. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 651 and UL Category Control Number DZYR.
2) Dimensional Specifications: Schedule 80.
c. Options:
1) Minimum Trade Size: 3/4 inch .
2) Markings: For directional boring applications.

C. Type A Rigid PVC Concrete-Encased Conduit (PVC-A) and Fittings:

1. Manufacturers: Subject to compliance with requirements, undefined:
a. Southern Pipe, Inc.
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 651 and UL Category Control Number DZYR.
2) Dimensional Specifications: Type A.
c. Options:
1) Minimum Trade Size: 3/4 inch .

D. Type EB Rigid PVC Concrete-Encased Underground Conduit (PVC-EB) and Fittings:

1. Manufacturers: Subject to compliance with requirements, undefined:
a. JM Eagle; J-M Manufacturing Co., Inc.
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 651 and UL Category Control Number DZYR.
2) Dimensional Specifications: Type EB.
c. Options:
1) Minimum Trade Size: 4 inch .

2.10 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Fittings for Type ERMC, Type IMC, and Type PVC Raceways:

1. Manufacturers: Subject to compliance with requirements, undefined:
a. ABB, Electrification Products Division.
b. Crouse-Hinds; Eaton, Electrical Sector.
c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 514B and UL Category Control Number DWTT.
2) Material: Steel Die cast.
3) Coupling Method: Compression coupling .

c. Options:
1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

B. Fittings for Type EMT Raceways:

1. Manufacturers: Subject to compliance with requirements, undefined:
a. ABB, Electrification Products Division.
b. Allied Tube & Conduit; Atkore International.
c. Calconduit; Atkore International.
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 514B and UL Category Control Number FKAV.
2) Material: Steel Die cast.
3) Coupling Method: Compression coupling .
c. Options:
1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

C. Fittings for Type LFMC Raceways:

1. Manufacturers: Subject to compliance with requirements, undefined:
a. Liquid Tight Connector Co.
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 514B and UL Category Control Number DXAS.

2.11 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Manufacturers: Subject to compliance with requirements, undefined:

1. ABB, Electrification Products Division.

B. Applicable Standards:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and approved by authorities having jurisdiction for application to threaded conduit assemblies.
2. General Characteristics:
a. Reference Standards: UL 2419 and UL Category Control Number FOIZ.

2.12 SOLVENT CEMENTS

A. Solvent Cements for Type PVC Raceways and Fittings:

1. Applicable Standards:
   a. General Characteristics:
      1) Reference Standards: As recommended by conduit manufacturer in accordance with UL 514B and UL Category Control Number DWTT.

2.13 METALLIC OUTLET BOXES, DEVICE BOXES, AND COVERS

A. 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, undefined:
   a. ABB, Electrification Products Division.
   b. Crouse-Hinds; Eaton, Electrical Sector.
   c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
3. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514A and UL Category Control Number QCIT.
   c. Options:
      1) Material: Sheet steel .
      2) Sheet Metal Depth: Minimum 2 inch .
      3) Cast-Metal Depth: Minimum 2.4 inch .
      4) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb more than 50 lb and marked with maximum allowable weight.
      5) Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.

B. 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, undefined:
   a. ABB, Electrification Products Division.
   b. Crouse-Hinds; Eaton, Electrical Sector.
   c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
3. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514A and UL Category Control Number QCIT.

C. Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Arlington Industries, Inc.
   c. Crouse-Hinds; Eaton, Electrical Sector.
3. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514A and UL Category Control Number QCIT.
   c. Options:
      1) Material: Sheet steel .
      2) Sheet Metal Depth: minimum 2 inch .
      3) Cast-Metal Depth: minimum 2.4 inch .
      4) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing .
      5) Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.

D. Metallic Floor Boxes and Floor Box Covers:

1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
2. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. AFC Cable Systems; Atkore International.
   c. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
3. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514A and UL Category Control Number QCIT.

2.14 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. Termination Boxes and Termination Bases for Installation on Line Side of Service Equipment:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. B-line; Eaton, Electrical Sector.
   c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

b. General Characteristics:
1) Reference Standards: UL 1773 and UL Category Control Number XCKT.
2) Listed and labeled for installation on line side of service equipment.

C. Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment:

1. Manufacturers: Subject to compliance with requirements, undefined:
a. ABB, Electrification Products Division.
b. B-line; Eaton, Electrical Sector.
c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 1773 and UL Category Control Number XCKT.
2) Listed and labeled for installation on load side of service equipment.

2.15 CABINETS, CUTOUT BOXES, JUNCTION BOXES, AND PULL BOXES

A. 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, undefined:
a. ABB, Electrification Products Division.
b. Adalet.
c. B-line; Eaton, Electrical Sector.
3. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL Category Control Number CYIV.
a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.
c. Options:
1) Degree of Protection: Type 1

B. 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, undefined:
a. ABB, Electrification Products Division.
b. Adalet.
c. B-line; Eaton, Electrical Sector.
d. Crouse-Hinds; Eaton, Electrical Sector.
3. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL Category Control Number CYIV.
a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.
c. Options:
1) Degree of Protection: Type 1

C. 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, undefined:
a. Adalet.
b. B-line; Eaton, Electrical Sector.
c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
3. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL Category Control Number BGUZ.
a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.
c. Options:
1) Degree of Protection: Type 1.

D. 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, undefined:
a. Adalet.
b. Crouse-Hinds; Eaton, Electrical Sector.
c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
3. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL Category Control Number BGUZ.
a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.
c. Options:
1) Degree of Protection: Type 1

E. 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, undefined:
a. ABB, Electrification Products Division.
b. Adalet.
c. B-line; Eaton, Electrical Sector.
3. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL Category Control Number CYIV.
a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.
c. Options:
1) Degree of Protection: Type 3X Type 3R .

F. Outdoor 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, undefined:
a. ABB, Electrification Products Division.
b. Adalet.
c. B-line; Eaton, Electrical Sector.
3. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL Category Control Number CYIV.
a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.
c. Options:
1) Degree of Protection: Type 3X Type 3R .

G. 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, undefined:
a. Adalet.
b. B-line; Eaton, Electrical Sector.
c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
3. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL Category Control Number BGUZ.
a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.
c. Options:
1) Degree of Protection: Type 3X Type 3R .

2.16 COVER PLATES FOR DEVICES BOXES

A. Nonmetallic Cover Plates for Device Boxes:

1. Manufacturers: Subject to compliance with requirements, undefined:

a. ABB, Electrification Products Division.
b. Arlington Industries, Inc.
c. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.

2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
      2) Wallplate-Securing Screws: Metal with head color to match wallplate finish.
   c. Options:
      1) Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
      2) Wallplate Material: 0.060 inch thick high-impact thermoplastic (nylon) with smooth finish and color matching wiring device .
      3) Color: White Office White As indicated on architectural Drawings.

2.17 HOODS FOR OUTLET BOXES

A. Retractable or Reattachable Hoods for Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
      2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
      3) Mounts to box using fasteners different from wiring device.
   c. Options:
      1) Provides white, weatherproof, "while-in-use" cover.

B. Extra-Duty, While-in-Use Hoods for Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. ABB, Electrification Products Division.
   b. Allied Tube & Conduit; Atkore International.
   c. Arlington Industries, Inc.
2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
      2) Marked "Extra-Duty" in accordance with UL 514D.

3) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
4) Mounts to box using fasteners different from wiring device.

c. Options:
1) Provides white, weatherproof, "while-in-use" cover.
2) Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

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 Conduit: ERMC .
2. Concealed Conduit, Aboveground: ERMC .
3. Direct-Buried Conduit: PVC-40.
4. Concrete-Encased Conduit in Trench: PVC-40 .
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:

1. Exposed and Subject to Physical Damage: ERMC . Raceway locations include the following:

a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
b. Mechanical rooms.
c. Fire Pump Room

2. Concealed in Ceilings and Interior Walls and Partitions: IMC EMT.
3. Damp or Wet Locations: IMC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC .

D. Stub-ups to Above Recessed Ceilings: Provide EMT, IMC, or ERMC for raceways.

E. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC and IMC: 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 Type 3 unless otherwise indicated.
   b. Locations Exposed to Hosedown: Type 6 .
   c. Locations Subject to Potential Flooding: Type 6P.
   d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
   e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X .
   f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.
2. Indoors:
   a. Type 1 unless otherwise indicated.
   b. Damp or Dusty Locations: Type 12 .
   c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
   d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12 .
   e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 6.
   f. Locations Exposed to Hosedown: Type 6 .
   g. Locations Exposed to Brief Submersion: Type 6P.
   h. Locations Exposed to Prolonged Submersion: Type 6P.
   i. Locations Exposed to Corrosive Agents: Type 4X .
   j. Locations Exposed to Spraying Oil or Coolants: Type 13.

C. Exposed Boxes Installed Less Than 6.5 ft. Above Floor:

1. Provide cast-metal boxes. Boxes with knockouts or unprotected openings are prohibited.
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. 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.
6. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4 inch trade size and insulated throat metal bushings on 1-1/2 inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
7. 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. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch of changes in direction.
4. 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.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within 12 inch of enclosures to which attached.
7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
8. 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. Where otherwise required by NFPA 70.
9. Keep raceways at least 6 inch away from parallel runs of flues and hot-water pipes. Install horizontal raceway runs above water and steam piping.
10. Cut conduit perpendicular to the length. For conduits 2 inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
11. 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 ERMC and IMC:
   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.

2. Types FMC and LFMC:
   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.
3. Type PVC:
   a. Do not install Type PVC conduit where ambient temperature exceeds 75 Degree F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted. PVC can only be used for underground installation outside of the building footprint.
   b. Comply with manufacturer's written instructions for solvent welding and fittings.

D. Stub-ups to Above Recessed Ceilings:

1. Provide EMT, IMC, or ERMC 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. ERMC-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 ERMC 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.
   e. .
3. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
5. 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 raceways only where indicated on Drawings.

B. Install surface raceway with a minimum 2 inch radius control at bend points.

C. 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. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

L. 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.

M. 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 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeve seal systems.
2. Grout.
3. Foam sealants.

B. Related Requirements:

1. Section 260010 "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 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVE SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. BWM Company.
3. CALPICO, Inc.

B. 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: Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.2 GROUT

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. W.R. Meadows, Inc.

B. 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.

2.3 FOAM SEALANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dow Chemical Company (The).
2. Innovative Chemical Products (Building Solutions Group).

B. 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. 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.

B. 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.

C. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

D. 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.

E. Underground, Exterior-Wall and Floor Penetrations:

1. Install steel pipe sleeves with integral waterstops. Size sleeves to allow for 1 inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.
2. Install steel pipe sleeves. Size sleeves to allow for 1 inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

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 260544

SECTION 260553 - 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. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Tags.
4. Signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of 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. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 degree F.

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 and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

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.
   d. Grounded/Neutral: White
3. Colors for 480/277-V Circuits:
   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Grounded/Neutral: Gray
4. Color for Equipment Grounds: Green or Green with a yellow stripe.
5. Colors for Isolated Grounds: Green two or more yellow stripes.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. 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."
3. As per NEC 2017. .

E. Equipment Identification Labels:

1. Black letters on a white field.
2. As per NEC 2017.

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. Champion America.
   c. emedco.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter 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.

C. Self-Adhesive Wraparound Labels: , 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. A'n D Cable Products.
   b. Brady Corporation.
   c. Brother International Corporation.
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: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.4 TAGS

A. 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.
2. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 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.

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.

2.6 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 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. 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.

H. 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.

I. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer load shedding .

L. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

M. 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."
3. "UPS."

N. Vinyl Wraparound Labels:

1. Secure tight to surface 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.

O. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

P. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

Q. Self-Adhesive Labels:

1. On each unit of equipment, 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.

R. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using cable ties.

S. 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.

3.2 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. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels self-adhesive wraparound labels snap-around 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.

E. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels 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.
   c. .

G. Arc Flash Warning Labeling: Self-adhesive labels.

H. Operating Instruction Signs: Self-adhesive labels Baked-enamel warning signs .

I. Emergency Operating Instruction Signs: Self-adhesive labels Baked-enamel warning signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer load shedding Emergency Generator .

J. Equipment Identification Labels:

1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine sign .

END OF SECTION 260553

SECTION 261116 - SWITCHBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Provide switchboards of size indicated on Drawings.

1.2 DESIGN REQUIREMENTS

A. Contractor shall provide an overcurrent protective device coordination study for the one line diagram up to second level fusing on the normal services.

B. A coordination study shall use computer program that are distributed nationally and are in wide use that comply with requirements of standards and guides specified in this article.

C. Comply with IEEE 241 for short circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

E. Computer software to be one of the following:

1. CYME (Eaton Corp)
2. ESA Inc
3. ETAP/ Operation Technology Inc
4. Power Analytics Corporation
5. SKM

F. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

G. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.

2. Retain first subparagraph below for medium-voltage equipment.
3. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.

4. Calculate the maximum and minimum ground-fault currents.

1.3 SUPPLEMENTAL SUBMITTALS

A. Submittals Package

Submit the Shop Drawings and Product Data specified below at the same time as a single package.

B. Product Data

1. For switchboard, overcurrent protective devices, ground-fault protectors, meter, SPD, and components indicated.

2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

C. Shop Drawings

1. Dimensioned and scaled plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.

b. Bus configuration, current, and voltage ratings.

c. Short-circuit current rating of switchboards and overcurrent protective devices.

d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: power, signal, and control wiring. Diagrams should differentiate between manufacturer-installed and field-installed wiring.

D. Provide Preliminary Overcurrent Protection Coordination Study findings prior to submittal of shop drawings for switchboards and overcurrent devices to allow review of those devices.

E. Certification of operability for switchboard to remain operable following the design earthquake ground motion per Section 13.2.2 of ASCE 7-10.

F. Overcurrent Protective Device Coordination Study Report include the following items:

1. The following parts from the Protective Device Coordination Study Report:

a. One-line diagram.
b. Protective device coordination study.
c. Time-current coordination curves.

2. Power system data.

G. Contract Closeout Submittals

1. Operation instructions
2. Maintenance requirements including torque-tightening values
3. Manufacturer's certification and field test reports.

H. Warranty

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver in sections of lengths that can be moved past obstructions in delivery path.

B. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Handle switchboard according to NEMA PB 2.1.Instructions for Proper handling, Installation and Maintenance of Switchboard).

1.5 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.6 WARRANTY

A. Provide a one-year Manufacturer’s warranty for equipment and materials. Warranty period starts at the substantial completion of work.

PART 2 – PRODUCTS

2.1 MANUFACTURES

A. Available Manufacturers:

1. Eaton Corp.; Cutler-Hammer Products.
2. Siemens Energy & Automation, Inc.
3. Square D Co.

2.2 MANUFACTURED UNITS

A. Front-Connected, Front-Accessible, rear aligned sections Switchboard mounted with:

1. Main Devices and Branch Devices: Individual and fixed.

B. Nominal System Voltage: 208Y/120

C. Main-Bus Continuous ampere rating without derating.

D. Switchboard shall be adequately braced to withstand an available short circuit current of 200,000 amperes RMS.

2.3 FABRICATION AND FEATURES

A. Enclosure: Steel: NEMA type. Cabinet shall consist of a rigidly constructed enclosure not less than # 14 gauge, cold rolled, steel for sections up to 900 square inches in area, and # 12 gauge for larger panel areas Gutter space shall be adequate for the conductors to be installed. Side gutters shall be not less than 4" for 100-ampere units, 6" for 200-ampere units and 8" for 400-600 ampere units. Top and bottom gutter space shall be not less than 12". Front trim of cabinet shall be designed so that gutter spaces will be accessible through hinged sections. No. 14-gauge steel angles or channels shall be provided to adequately support distribution equipment from floor with necessary bracing. Enclosure Finish: Factory-applied electro-static powder coating in manufacturer's standard gray finish.

B. Insulation and isolation for main and vertical buses of feeder sections.

C. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

D. Pull Box or Crown Box on Top of Switchboard: Include the following features:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.

2. Insulated supports for all conductors shall be arranged to facilitate cabling.

3. Pull box shall be #12 gauge sheet steel, and finished in a manner similar to Distribution Board.

E. Buses and Connections: Three-phase, four-wire. Include the following features:

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity with feeder circuit-breaker line connections.

2. Ground Bus: 1/4” by 2” (6-by-50-mm) minimum size, drawn-temper copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3. Contact Surfaces of Buses: Silver-plated.

4. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.

5. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

6. Neutral Buses: 100 percent of the ampacity of the phase buses, unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus is braced.

7. Switchboard bus shall be rated per New York City Electrical Code articles 230.42 and 408.51.

8. All live parts shall be a minimum clearance of 12” above the finished floor.

2.4 METERING

A. Contractor shall provide selectable display of the following values with maximum accuracy tolerances as indicated:

1. Phase Currents, Each Phase: Plus or minus 1 percent.

2. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.

3. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.

4. Mounting: unit flush or semiflush mounted in door.

B. Ammeters, Voltmeters

1. Meters: Display readings shall be provided by a Digital Type Meter that is factory installed programmed and tested

2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

3. Provide control power fuses and shorting blocks.

C. Instrument Switches: Digital pushbutton.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.

2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.

D. Main Electric Service Equipment shall come equipped with a factory supplied and programmed communication interface to allow connection to a BACNET Building

Management System and display all measured parameters associated with that meter at the installed Building Management System GUI.

1. Panel Meter shall also have a hard-wired pulse output for connection to a Building Management System that will indicate KWh Total Energy Consumption.

2. Products: Models are to be provided with option, if not standard, to provide the required data listed above.

   a. Schneider Electric (Square D) ION 6200

   b. Siemens SENTRON PAC3100

   c. General Electric Industrial (ABB) EPM 2200

   d. Eaton Electric Power Xpert 2000

   e. SATEC PM172E-SO-FS

   f. SATEC BFMII

3. Meter manufacturer to provide on-site commissioning service to verify meter data.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; external lockable handle.

Fusible Switch Units shall consist of twin or single type units of ampere (and corresponding horsepower) rating indicated. Unit shall have provision for padlocking. The individual units shall bear Underwriter's Laboratories, Inc. listing. Individual 30-ampere units shall be interchangeable with 60-ampere units and operating handles shall not exceed 6'-7" above floor and be not less than 18" above floor.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
Entire assembly shall be securely fastened to switchboard structure. All breakers shall be of the bolt on type. Breakers shall be mounted so that they can be removed without disturbing bus work or the adjacent breaker. Where space for future breaker is called for, all copper connectors and provisions for mounting the breaker shall be provided.

C. System Series ratings are not permitted for any overcurrent protection device.

2.6 NAMEPLATES

A. Each unit of equipment shall be provided with a riveted phenolic nameplate, identifying the equipment and its rating.

B. On each Circuit breakers and fused switch, indicate ampere rating, fuse size and fuse type (or circuit breaker type and setting) circuit designation).

C. On Switchboard, indicate ampere rating, nominal voltage, phases short-circuit current rating of switchboard, and switchboard.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Switchboard

1. Install switchboards on concrete bases, 4” (100-mm) nominal thickness.

2. Foundation Channel and Bolts: Install channel for anchoring and leveling of the switchboard and solidly anchor to floor and/or wall.

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 NAMEPLATES

A. Label each switchboard compartment and circuits with phenolic nameplate. Precision engrave letters and numbers with uniforms margins, character size minimum 3/16" high.

B. Install identity sign on switchboard entry door as follows:

-- ELECTRICAL SWITCHBOARD ROOM --
-- NO STORAGE PERMITTED --

Lettering in luminous-white shall be not less than 2½" height and 5/8" width.

3.4 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the overcurrent protection coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.05 TESTS

A. Provide third party services to completely test the installed switchboard, including insulation resistance of each switchboard bus and components and megger tests.

B. Demonstrate that overcurrent protection device settings match final overcurrent protection study and submit report.

C. Provide certification and test reports from the manufacturer's representative that the assembled switchboard, as installed meets UL, NEMA, and SCA Standards.

D. Switchboard shall have a label indicating listing by the Underwriters Laboratories, Inc.

3.6 CLEANING

On completion of installation, Contractor shall inspect interior and exterior of switchboards. Remove paint splatters and spots and vacuum dirt and debris. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

Provide panelboards of sizes indicated on Drawings.

1.2 SUPPLEMENTAL SUBMITTALS

A. Submittal Packages

Submit the Shop Drawings, and the product data specified below at the same time as a package.

B. Product Data

Provide manufacturer’s information on panelboards and breakers, including dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

C. Shop Drawings; include the following for each panelboard:

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices equipment features, and ratings.

2. Cabinet and gutter size.

3. Bus configuration, voltage and current rating.

4. Unless otherwise noted, Panelboard short circuit rating shall conform to U.L. Standards for fully rated systems only.

5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

D. Panelboard Schedules: For installation in panelboard. Submit final versions after load balancing.

E. Field Test Reports: Submit written test reports and include the following:

1. Test Procedures used

2. Test results

F. Warranty

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB1.

C. Comply with NFPA 70.

D. Comply with UL 67.

1.4 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

B. Electrical contractor shall make necessary modifications to the existing building elements to accommodate the new panelboards in the existing spaces.

1.5 WARRANTY

A. Provide a one-year Manufacturer’s warranty for equipment and materials. Warranty period starts at the substantial completion of work.

PART 2 - MATERIAL - PRODUCTS

2.1 PANELBOARDS - CIRCUIT BREAKER TYPE

A. Equipment manufactured by General Electric Co., Siemens, Square D Co., Eaton:

1. Bus bars and lugs shall not be less than 98% conductivity, hard drawn copper. All copper bus connections shall be bolted with lock washers and joints shall be silver-plated.

2. Full capacity copper neutral bus in panelboards where neutrals are required.

3. Copper equipment grounding bus in panelboards where equipment grounding conductors are required.

4. Section designated "space" or "provision for future breaker' equipped to accept future circuit breakers.

5. Molded-Case Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Circuit breakers shall be bolt on. Plug-in type breakers are not acceptable.

B. GFCI (30mA Type) circuit breakers shall be provided for designated circuits.

C. Panelboard Cabinets

1. Flush and surface mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

4. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

D. Locks

Provide locks for panelboard cabinets located outside electrical rooms/closets. Locks shall be of approved cylinder, paracentric type, Yale No. 511S, Key change No. 47. Two keys shall be supplied with each lock.

E. Directories

A directory consisting of a steel or aluminum frame with a non-breakable, non-inflammable plastic face with either cardboard or heavy white paper beneath shall be installed on the inside of the door of cabinets for all panelboards. Frame shall be welded to door or fastened by approved screws to a mat in such a manner as not to leave anything projecting on the outside of the door. The cardboard or heavy paper shall have typewritten directory thereon stating the following: The number of each circuit together with the name of circuits, load controlled, size of circuit feeder and subfeeder conductors. Directory frames shall be not less than 8" x 8".

2.2 PANELBOARD - SWITCH FUSE TYPE

A. Provide a dead front, handle operated, fusible switch panelboard where indicated. The assembled panelboard shall have a label indicating approval by Underwriters Laboratories, Inc. and shall meet the requirements of NEMA Standards. In general, panelboard construction shall be identical to that specified for circuit breaker panelboards.

All necessary devices and connections shall be complete and in accordance with the following Specifications.

1. Fusible Switch Units shall consist of twin or single type units of ampere (and corresponding horsepower) rating indicated. Units shall be quick make, quick break, heavy-duty switch and fuse mechanism, individually enclosed by a hinged steel cover and external operating handle indicating "ON" and "OFF" position to switch. Switches shall be of design to minimize arcing and pitting when rupturing current and shall be equipped with arc quenchers. Wiring terminals

shall be solderless pressure type lugs. Cover of unit shall be interlocked so that door cannot be opened except when switch is in "OFF" position. Unit shall have provision for padlocking. The individual units shall bear Underwriter's Laboratories, Inc. listing. Operating handles shall not exceed 6'-7" above finished floor and not less than 18" above floor elevation.

2.3 NAMEPLATES

A. Each unit of equipment shall be provided with a riveted phenolic nameplate, identifying the equipment and its rating.

B. On each circuit breaker and fused switch, indicate ampere rating, fuses size and fuses type (or circuit breaker type and setting) and circuit designation.

C. On panelboard, indicate ampere rating, nominal voltage, phases, and panelboard designation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA Publication No. PB1.1 "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or less".

B. Cabinet Supports

1. Panelboards set in chases shall be supported to chase structural members.

2. Panelboards set in walls where a chase is not provided by others, shall be provided with Kindorf channels on both sides of the panel with these channels running from floor slab to ceiling slab and secured to both.

3. Surface mounted panels shall be fastened to walls by expansion shields, or the equivalent. Heavy panelboards shall be supported from the floor by means of approved angle iron framework.

4. Steel angle or channel supporting members shall be provided to adequately support distribution equipment for floor mounting with all necessary bracing.

C. Setting of Cabinets

Panelboards set above wainscot shall be set so that bottom of trim shall be 1/2" above wainscot. Where wainscot is approximately 7'-0" above floor, top of panel shall line up with it unless otherwise detailed or directed.

Elsewhere in the building, panelboards shall be set so that top of cabinet is approximately 6 feet 6 inches above floor.

D. Flush Cabinets

Where building construction does not permit cabinets being set flush or where cabinet is extra deep, the front shall project out from the wall and the sides of the cabinet shall be trimmed and finished with a metal return molding of approved design, fastened to cabinet so as to conceal the intersection between the wall and the cabinet.

E. Cleaning

On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.2 TESTS

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder and control circuit.

2. Test continuity of each circuit.

B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance measure load balancing. Difference exceeding 20% between phase load is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

D. Demonstrate panel directory accuracy where required by the CxA for all panelboards.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard-commercial grade receptacles, 125 V, 20 A, 2P, 3W.
2. Surge suppression type receptacle 125V, 20A, 2P, 3W.
3. GFCI receptacles, 125 V, 20 A, 2P, 3W.
4. Dual-Controlled Plug Load Receptacles 2P, 3W.
5. Decorator-style devices, 20 A, 2P, 3W.
6. Wall plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Coordinate with the receptacle that are part of the furniture being provided by other trades. Provide coordinated shop drawings indicating the furniture mounted receptacles and associated circuiting that matches with the furniture mounted circuit arrangement.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports

B. Coordinate with the receptacles that are part of the furniture being provided by other trades. Provide coordinated shop drawings indicating the furniture mounted receptacles and associated circuiting that matches with the furniture mounted circuit arrangement. Any changes to the circuiting information provided in the contract drawings to match with the circuit information of proposed furniture shall be part of this contract and there will be no additional cost to the contract for these changes.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Straight-blade-type; Commercial Specification Grade minimum; compliance with NEMA WD 1; DSCC WC 596, AND UL 498 and UL 943 2006 Codes.

E. Device Color:

1. Wiring Devices Connected to Normal Power System: White As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Essential Electrical System: Red.
3. SPD Devices: Blue.
4. Isolated-Ground Receptacles: Orange As specified above, with orange triangle on face.

F. Wall Plate Color: For plastic covers, match device color.

G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Leviton Manufacturing Co., Inc.
   b. Pass & Seymour; Legrand North America, LLC.
   c. Hubbell Inc.
2. Description: Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Leviton Manufacturing Co., Inc.
   b. Pass & Seymour; Legrand North America, LLC.
   c. Hubbell Inc.

2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Weather-Resistant Duplex Receptacle, 125 V, 20 A :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Leviton Manufacturing Co., Inc.
   b. Pass & Seymour; Legrand North America, LLC.
   c. Hubbell Inc.

2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.
5. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

D. Transient Voltage Surgé Suppression Réceptacle TVSS; duplex (20A, 125V, 2P, 3W);

1. Hubbell Inc HBL5360SA
2. Leviton 5380
3. Pass & Seymour/Legrand PS5362-ISP

E. Floor mounted (Poke thru) receptacle : 2- Duplex (20A, 125V, 2P, 3W) plus 2 RJ-45 jack

1. WireMold # RC4ATCBS/COM75
2. Hubbell Inc.
3. Leviton
4. Or approved equal.

F. Twisted Lock receptacles Commercial Grade For use in the Telecommunication Rooms/IT/AV rooms

1. Single receptacle (30A, 125V, 2P 3W) (NEMA L530R):
   a. Leviton part# 2660
   b. Hubbell Part # HBLL530R
   c. Approved equal from Legrand.
2. Single receptacle (20A, 220V, 2P 3W) (NEMA L620R):
   a. Leviton Part# 2320
   b. Hubbell Part # HBLL530R
   c. Approved equal from Legrand.

G. Dual-Controlled Plug Load Receptacles:

1. Shall comply with UL 498 and shall be permanently marked with control symbol and “CONTROLLED” on the face of the actual outlet as required by 2014 NEC 406.3 and ASHRAE 90.1
2. Shall be Pass & Seymour #5362CD Series or approved equal.

3. Duplex receptacle 20A, 125V, 2 poles, 3W, grounded.

H. Under desk power dock, under mounted below the counter surface (Mockett outlet) with 2 power/dual charging USB
1. Easy-to-install under-desk mounting tabs. Refer to drawings for location. Coordinate with furniture/desk submittal.
2. 2 Power Outlets, 20A, 125V, 2 poles, 3W, grounded
3. Dual USB charger
4. UL listed
5. Shall be Doug Mockett # PCS99B or equivalent

2.3 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Leviton Manufacturing Co., Inc.
   b. Pass & Seymour; Legrand North America, LLC.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A :

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Pass & Seymour; Legrand North America, LLC.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Leviton Manufacturing Co., Inc.
   b. Pass & Seymour; Legrand North America, LLC.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-15R.

4. Type: Feed through.
5. Standards: Comply with UL 498 and UL 943 Class A.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.4 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Non-metalic
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
5. Material to cover existing back boxes after removal of existing outlets and switches: 0. Type 302 stainless steel 0.04-inch- thick.

C. Wall Plate Color: For plastic covers, match device color.

D. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant , die-cast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
2. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
3. Install wiring devices after all wall preparation, including painting, is complete.

C. Device Installation:

1. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right .
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD TEST:

A. Ensure that proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements of these Specifications.

END OF SECTION 262726

SECTION 262813 - OVERCURRENT PROTECTIVE DEVICES, CIRCUIT BREAKERS AND FUSES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Provide circuit breakers and fuses for use in panelboards, switchboards, and fuses for use in switches, controllers, motor-control centers, and spare fuse cabinets.

1.2 SUPPLEMENTAL SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

B. Close-out Submittals

1. Spare parts

1.3 SPARES

A. Provide and deliver the following spare fuses:

1. Three (3) fuses of each type and size for all fuses.

1.4 ELECTRICAL SYSTEM COORDINATION

A. Rating and arrangement of fuses, or overcurrent devices on service switches, which have a rating above 601 amperes, shall be selectively coordinated.

PART 2 – PRODUCTS

2.1 CIRCUIT BREAKERS

A. General

Circuit breakers shall be thermal-magnetic type, conforming to the following Specifications:

1. Connection to bus shall be by "bolt-on". Plug-in type circuit breakers are not acceptable.

2. Multi-pole breakers shall have barriers between poles

3. Multi-pole breakers shall have separate tripping element for each pole with a common internal trip. Each tripping element shall open all poles. Multi-pole breakers shall have one handle controlling all poles. Handle ties shall not be used as the means of tripping multiple poles.

4. Breakers of 225-ampere trip rating or less shall have non-tamperable, permanently set trip elements enclosed and sealed in molded composition housing.

5. Single pole breakers shall be rated for not less than 120 volts, A.C., multi-pole breakers shall be rated for not less than 250 volts A.C.

6. Where spaces for future breakers are required, copper connections for mounting of future breakers shall be provided.

7. Circuit breakers shall be mounted in standard panel boards as indicated on the drawings. Frame and sizes of circuit breakers shall conform to the following:

   a. Use standard molded-case type.
   b. For lighting circuits controlled at the panel, provide circuit breakers rated and labeled for switching duty.
   c. For circuit breaker serving heat tracing, snow melting or similar heating devices provide GFI feature (30-milliamp sensitivity) as shown on the drawings.
   d. For circuit breakers serving convenience receptacles in bathrooms, kitchens and other such code-mandated locations provide GFI feature (5 milliamps sensitivity) as shown on the drawings.

Table with Frame Size, Trip Rating, Short Circuit Interrupting Capacity and Basis of Design Manufacturers:

Trip Ratings-Amps	No. of Poles	Frame Size
15–30	1	<u>100 AMP – Frame</u> 120/240V: Square D, Type QOB-VH (22,000 I.C.) 120/240V: Square D, Type QOB-VH (65,000 I.C.)

15–20		120-240V: Cutler-Hammer, Type GHBS (65,000 I.C.)* 480/277V: EHB (14,000 I.C.) <u>125 AMP – Frame</u>
15-125		120V: SIEMENS, Type BLH (22,000 I.C.)
		<u>100 AMP – Frame</u>
15-100	2&3	120/240V: Square D, Type QOB-VH (22,000 I.C.)
15-30	2&3	120/240V: Square D, Type QOB-VH (65,000 I.C.)
15-30	2&3	240V: Cutler-Hammer, Type GB (65,000 I.C.)*
		<u>125 AMP – Frame</u>
15-125	2&3	240V: SIEMENS, Type ED4 (65,000 I.C.)
		<u>225 AMP – Frame</u>
101-225	2&3	240V: Square D, Type KA (42,000 I.C.)
125-225	2&3	240V: Cutler-Hammer, Type HCA (42,000 I.C.)*
125-225	2&3	240V: SIEMENS, Type QJH2 (22,000 I.C.)
226-400	3	<u>400 AMP - Frame</u> 240V: Square D, type LA (42,000 I.C.) 480V: Type LA (30,000 I.C.) 240V: SIEMENS, Type JXD2 (65,000 I.C.) 480V: SIEMENS, Type JXD6 (35,000 I.C.)

2.2 FUSES

A. Fuses of type and voltage required, shall have a minimum interrupting rating of 200,000 R.M.S. amperes and be the equal of Bussmann or Gould Shawmut.

1. 600 Amp and Below:

a. UL listed as class RK-1 and RK-5, similar to Bussmann type Low Peak LPN-RK, 250 volt or Low Peak LPS-RK, 600-volt. Where intended for use in motor starters fuses shall be of the dual element, time-delay type.
Provide with kit for rejecting all but class R fuses.

b. UL listed as class J, similar to Bussmann time delay, type Low Peak LPJ, or quick acting Limitron JKS, 600 volt,

2. 601 to 6000 Amp:

a. UL listed as class L, time delay, current limiting type similar to Low-Peak KRP-C, 600Volt.

B. All fuses shall be the product of the same manufacturer. All devices shall have the same fuse type of the same manufacturer.

2.3 SPARE FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull. Shall be installed in the Main Service Room.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1½” (40 mm) high letters on exterior of door.
4. Fuse Pullers: For each size fuse.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

END OF SECTION

SECTION 262816 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide enclosed switches.

1.2 SUPPLEMENTAL SUBMITTALS

A. Product Data

1. Switches
2. Enclosure

B. Test Reports

1. Insulation Resistance
2. Continuity

PART 2 - PRODUCTS

2.1 ENCLOSED SWITCHES

A. Approved Manufacturers:

1. Square D.
2. Eaton
3. General Electric
4. Siemens

B. Voltage Ratings

1. 250V rating for 120V, 208V, or 240V, circuits.
2. 600V rating for 277V and 480V circuits.

C. Solid neutral bar when neutral conductor is included with circuit.

2.2 ENCLOSED SWITCHES

A. Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.

B. Fusible Switch, 800 A or Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position. General Duty switches are not acceptable.

C. Fusible Switch, 1200 A or Larger: Bolted pressure type, UL 977; operating mechanism shall utilize a rotary-mechanical bolting action to produce and maintain high clamping pressure on the switch blade after it engages stationary contacts.

D. Fusible Switch Supplying Step-Up Transformer: High-pressure Butt Type Contact (HPC); UL 977, operating mechanism shall use butt-type contact and spring-charged mechanism to produce and maintain high contact pressure when switch is closed. Switch shall remain closed against an inrush up to 12 times the face amps of the device.

2.3 ENCLOSURES

A. NEMA AB 1 and NEMA KS1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, type 3R.
2. Wet or Damp locations: NEMA 250, type 4.

2.4 FACTORY FINISHES

A. Finish: Manufacturer’s standard paint applied to factory-assembled and tested enclosures before shipping.

2.5 NAMEPLATES

A. General

Precision engrave letters and numbers with uniforms margins, character size minimum 3/16" high.

1. Phenolic: Two color laminated engravers stock, 1/16" minimum thickness, machine engraved to expose inner core color (white).

2. Materials for Outdoor Applications: As recommended by nameplate manufacturer to suit environmental conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install switches so that the maximum height above the floor to the center of the operating handle does not exceed 6'-6". When shown as wall mounted, switches shall be mounted to horizontal strut supports. Free standing units shall be mounted on a free-standing strut system anchored to the floor, ceiling, and walls.

3.2 TESTS

A. Test insulation resistance for each enclosed switch.

B. Test continuity of each line- and load-side circuit.

END OF SECTION

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of LED luminaires:

1. Cylinder.
2. Downlight.
3. Highbay, linear.
4. Linear industrial.
5. Recessed, linear.
6. Surface mount, linear.
7. Surface mount, nonlinear.
8. Suspended, linear.

B. Provide luminaires as per product data, type of fixtures, model number, manufacturer and descriptions shown in lighting fixture schedules and plans indicated in contract drawings.

C. Provide luminaires, supports and accessories including plaster frames, trim rings and back boxes for plaster, drywall, or concrete ceilings as necessary.

D. Coordinate with other trades to avoid conflicts between installation of luminaires and supports with the installation of mechanical equipment, ceiling structures, etc.

E. All luminaires shall operate on nominal 120/277 volts, 60 Hz single phase service as indicated on the Drawings and in the Specifications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
2. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings:.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Provide Photometric Calculation of each interior spaces to comply with minimum IES recommended FC level as well as 2020 NYS energy compliance requirements.

D. Sustainable Design Submittals:

1. Product Data: Indicating luminaire is certified by ENERGY STAR .

E. Submission of Substitute Luminaires upon written approval from the authority(luminaires other than specified herein or on the Lighting fixture Schedule in contract drawings).

1. Submittals for substitute luminaires shall be the standard print catalog sheets from the manufacturers (CADD drawings and computer printouts are not acceptable).

2. Substitute luminaires shall meet or exceed photometric quality of luminaires designated on the schedule. Photometric data of substitute luminaires shall be substantiated by an independent testing lab, such as I.T.L. Photometric data by Lumen Micro or similar software programs are not acceptable.

3. Substitute luminaires shall meet or exceed the quality of the luminaires designated on luminaires schedule in construction, finishing, materials, reflector, diffuser etc.

4. Substitute luminaires shall closely match the appearance, dimensions and features of the luminaires designated.

5. Submit one sample of each type of substitute luminaires as requested, with one set of mounting hardware for approval.

6. In order to ensure that the work is performed in an orderly and expeditious manner, the Contractor

7. Provide Photometric Calculation of each interior spaces to comply with minimum IES recommended FC level as well as 2020 NYS energy compliance requirements

8. No more than three (3) submittals shall be permitted for substitution of each specific luminaire type. Should the third submittal be rejected, the Contractor shall be required to provide the luminaires specified on the lighting fixture schedule.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Product Certificates: For each type of luminaire.

C. Sample warranty.

D. Mock-up

E. Spare Parts: Provide complete luminaires to the Campus of 5% of the order Delivered with a minimum of 2 fixtures for each type. Spares shall be provided and delivered to the Authority's Representative with an itemized list and a receipt taken, certifying that these spare parts have been delivered securely packed and received in acceptable condition

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Provide luminaires from a single manufacturer for each luminaire type.

B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires. Final color temperature selection of each luminaires shall be determined and approved by the Campus and Architect office prior to ordering the luminaires.

A. Qualifications

1. Manufacturer: Provide products of firms listed in Part 2 that are regularly engaged in the manufacture of lighting fixtures and components of types and ratings required and whose products have been in satisfactory use in similar service for not less than 5 years. The manufacturer of the lighting fixtures and components shall comply with the provisions of the appropriate code and standards. All fixtures shall be pretested before shipping.

B. Mock-Up

1. If a substitution is proposed for a space/classroom luminaires, the Contractor is to install a mock-up utilizing the proposed luminaire(s) for an entire classroom in a school designated by the Authority to prove out the quantity and quality of light documented in the lighting submittals. The Contractor is responsible to arrange with the designated school to install the luminaires after school hours and pay all custodial fees. After review by the Authority, the Contractor shall reinstall the original luminaires if the luminaire(s) is deemed not to be acceptable or the school does not desire to retain the luminaire.

C. Design Qualification Testing

1. Design Qualification Testing shall be performed by a National Voluntary Laboratory Accreditation Program (NVLAP) testing facility. Such testing may be performed by the manufacturer or an independent testing lab hired by the manufacturer on new luminaire designs and when a major design change has been implemented on an existing design. A major design change is defined as a design change (electrical or physical), which changes any of the performance characteristics of the luminaire, results in a different circuit configuration for the power supply, or changes the layout of the individual LEDs in the module.

2. A quantity of two units for each design shall be submitted for Design Qualification Testing.

3. Product submittals shall be accompanied by product specification sheets or other documentation that includes the designed parameters as detailed in this specification. These parameters include (but are not limited to):

a. Maximum power in Watts.

b. L80 in hours, when extrapolated for the worse case operating temperature. TM21 report shall be submitted to demonstrate this.

D. Product submittals shall be accompanied by performance data that is derived in accordance with appropriate IESNA testing standards and tested in a laboratory that is NVLAP accredited for Energy Efficient Lighting Products

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires and drivers that fail in materials, loss of performance and workmanship within specified warranty period. All warranty documentation shall be provided to customer prior to the first shipment

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:
   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter, shape, size, wattage, and coating.
   c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

2.2 DOWNLIGHT .

A. Manufacturers: Refer to lighting fixture schedule in contract drawings E501, for the manufacturer of luminaires and list of approved equals.

B. Nominal Operating Voltage: 120/277V .

C. LED Lamp:

1. Lumen output as per lighting fixtures schedule shown in contract drawings.
2. Minimum allowable efficacy of 90 lm/W.
3. CRI of minimum 90 . CCT of 3500K-4000k .
4. Rated lamp life of 50,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:
   a. Bulb shape complying with ANSI C78.79, C78.50
   b. base complying with ANSI C81.61 or IEC 60061-1.
8. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. painted finish.
3. Universal mounting bracket.
4. Integral junction box with conduit fittings.

E. 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.

F. Diffusers and Globes:

1. Fixed lens.
2. Medium light distribution.
3. Clear glass .
4. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
5. Glass: Annealed crystal glass unless otherwise indicated.
6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

G. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. Recessed luminaires shall comply with NEMA LE 4.

2.3 LINEAR INDUSTRIAL .

A. Manufacturers: Refer to lighting fixture schedule in contract drawing E501, for the manufacturer of luminaires and list of approved equals.

B. Nominal operating voltage 120/277V.

C. LED Lamp:

1. Lumen output as per lighting fixtures schedule shown in contract drawings.
2. Minimum allowable efficacy of 90 lm/W.
3. CRI of minimum 80 90 . CCT of 3500K-4000K .
4. Rated lamp life of 50,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. Lamps: LED array or board
8. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. painted finish.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:

1. Clear glass .
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

G. With integral mounting provisions.

H. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.

2.4 SURFACE MOUNT, NONLINEAR

A. Manufacturers: Refer to lighting fixture schedule in contract drawings, for the manufacturer of luminaires and list of approved equals.

B. Nominal Operating Voltage: 120/277V.

C. LED Lamp:

1. Lumen output as per lighting fixtures schedule shown in contract drawings.
2. Minimum allowable efficacy of 90 lm/W.
3. CRI of minimum 80 90 . CCT of 3500k-4000k .
4. Rated lamp life of 50,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:
   a. Bulb shape complying with ANSI C78.79.

b. Lamp base complying with or IEC 60061-1.

8. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink.
2. painted finish.
3. With integral mounting provisions.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:

1. Prismatic glass .
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

G. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. ENERGY STAR certified.
5. RoHS compliant.
6. UL Listing: Listed for damp location.

2.5 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

2.6 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 LUMINAIRE COMPONENTS/ACCESSORIES

A. Stems and Hickeys

1. Stems for pendant luminaires shall be standard pipes not less than 3/8" diameter. Stems shall be no less than 6" long with a cut thread. Pipe stems at luminaire end shall have a length of threads of approximately $1^{1}/_{2}$" for luminaire alignment.

2. Each stem shall be provided with a brass/steel swivel or other self-aligning device of type approved by the Authority, a hickey, a malleable iron bushing, a canopy, minimum of three locknuts/washers (one locknut/washer above and two below for locking purpose) and other accessories for the safe support of pendant luminaires.

B. Luminaire Finishes

1. The finish of all luminaires not described on the luminaire schedule or in the Specifications shall be as selected by the Authority's Representative. The Contractor shall submit a color chart to the Authority's Representative for selection of finish.
   a. Exterior Luminaires shall have an anodized or baked powder coat finish.

D. Luminaire-mounted Occupant Sensors

1. Occupant sensors shall be the luminaire manufacturer’s recommended unit compatible with the luminaire.

2. Sensor shall be auto-on to 100% and programmed such that in the off position the luminaires are dimmed to 50%.
3. Sensor mount locations in luminaire(s) shall be determined by the manufacturer’s specifications based on luminaire location.

2.8 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded

attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Comply with requirements in Section 260519 "Electrical Power Conductors and Cables" for wiring connections.

F. Recessed Luminaires weighting more than 50 pounds

1. A recessed luminaire weighing more than 50 pounds shall not be installed directly on a concealed or exposed ceiling spline of a mechanical acoustical ceiling system. Such luminaires shall only be supported from the building structure.

2. Support recessed luminaires with hanger rods, 3/16" in diameter minimum, attached to structural steel, concrete, beams, joists, trusses, and channels.

4. Contractor shall provide additional running bars or channels required to support the luminaire.

G. Recessed Luminaires weighting 50 pounds or less

1. Recessed luminaires weighting 50 pounds or less may be directly supported by suspended ceiling grid (Z bars, T grid, cross beams) providing that the maximum allowable deflection ($1/360^{th}$ of the span) is not exceeded. Recessed luminaires so supported shall be additionally secured with safety chains or aircraft cable that can fully support the weight of the luminaire in the event of a failure of the suspended ceiling. Safety chains or aircraft cable shall support each luminaire at two diagonal corners and shall be attached to the building structural steel or concrete.

H. Surface and Pendant Mounted Luminaires on Suspended Ceiling

1. Surface mounted and pendant luminaires shall be supported above suspended ceiling by hanger rods, 3/16" in diameter minimum, or by 12-gage hanger wire, vertically attached to structural steel or concrete.

2. Below suspended ceiling, support pendant luminaires with 3/8" stems or stainless steel cable.
3. Direct/indirect luminaires shall be supported by approved aircraft cables, vertically attached to building structural steel or concrete in accordance with the manufacturers installation recommendations. The luminaires' suspension cable shall be independently rated to support an 800 lbs load, and this shall include the suspension adjustment device that shall be located on luminaires

I. General:

1. The Contractor shall be responsible for the proper and safe mounting and support of all luminaires. Installation shall meet all the requirements of the National Electrical Code. Provide all items of equipment (stems, hangers, rods, inserts, boxes, brackets, yokes, channels, frames, etc.) required to adequately and safely support each luminaire in a manner acceptable to the Authority.

2. Provide a luminaire at each location shown on Drawings of the type indicated by symbol or other notation. If the type is not specifically noted on Drawings, the Contractor shall provide without extra cost luminaires of the same type called for under similar condition elsewhere on the Drawings as determined by the Authority.

3. The Contractor shall examine the drawings and coordinate closely with the all General Construction trades on all work involved with each type of luminaire to be installed. Contractor shall verify all sizes, locations and conditions under which luminaire are to be installed. Provide plaster frames and running bars (black iron) etc. as required.

4. The Contractor is required to protect luminaires from damage during installation, up to time of acceptance by the Authority. Any broken or marred luminaire, glassware, plastics, lamps, etc. shall be replaced by the Contractor at no additional cost to the Authority.

5. A suitable outlet box shall be provided by the Contractor for each luminaire provided. The box shall be cast into concrete or supported using two double split type anchors when installed in concrete walls or ceiling.

6. A surface or pendant type luminaire, regardless of its weight, shall not be mounted directly on the concealed or exposed ceiling spline of a lightweight, mechanical acoustical ceiling system. Such luminaires shall be supported from the building structure.

7. For all pendant mounted luminaires, regardless of weight and ceiling types, provide outlet boxes capable of supporting up to 150 pounds, Westinghouse model 01050/01052 or equal

a. IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

b. FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power/generator power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265119