

PROJECT MANUAL:

SCHOOL OF CONSTRUCTION PRACTICE LAB BUILDING
UNIVERSITY OF LOUISIANA MONROE
MONROE, LOUISIANA

State Project Number 19-629-23-01, F.19002614
ID S08890 Site code 8-37-007

STATE OF LOUISIANA

JEFF LANDRY - GOVERNOR

DIVISION OF ADMINISTRATION

JAY DARDENNE - COMMISSIONER OF ADMINISTRATION

OFFICE OF FACILITY PLANNING & CONTROL

MATT BAKER - DIRECTOR

Architect's Project Number
24-0059

Date
November, 2025

TBA

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LOUISIANA UNIFORM PUBLIC WORK BID FORM

TO: The State of Louisiana - Office of FP&C
1201 N. Third Street, Suite 7-160
Baton Rouge, LA 70802 or
PO Box 94095, Baton Rouge, LA 70804
(Owner to provide name and address of owner)

BID FOR: School of Construction Practice Lab Building
University of Louisiana Monroe
Monroe, LA
Project No. 19-629-23-01, F. 19002614
(Owner to provide name of project and other identifying information)

The undersigned bidder hereby declares and represents that she/he: a) has carefully examined and understands the Bidding Documents, b) has not received, relied on, or based his bid on any verbal instructions contrary to the Bidding Documents or any addenda, c) has personally inspected and is familiar with the project site, and hereby proposes to provide all labor, materials, tools, appliances and facilities as required to perform, in a workmanlike manner, all work and services for the construction and completion of the referenced project, all in strict accordance with the Bidding Documents prepared by: TBA Studio and dated: November 2025.

(Owner to provide name of entity preparing bidding documents.)

Bidders must acknowledge all addenda. The Bidder acknowledges receipt of the following **ADDENDA:** (Enter the number the Designer has assigned to each of the addenda that the Bidder is acknowledging) _____.

TOTAL BASE BID: For all work required by the Bidding Documents (including any and all unit prices designated "Base Bid" * but not alternates) the sum of:

_____ Dollars (\$ _____)

ALTERNATES: For any and all work required by the Bidding Documents for Alternates including any and all unit prices designated as alternates in the unit price description.

Alternate No. 1 *(Owner to provide description of alternate and state whether add or deduct)* for the lump sum of:

_____ N/A _____ Dollars (\$ _____ N/A _____)

Alternate No. 2 *(Owner to provide description of alternate and state whether add or deduct)* for the lump sum of:

_____ N/A _____ Dollars (\$ _____ N/A _____)

Alternate No. 3 *(Owner to provide description of alternate and state whether add or deduct)* for the lump sum of:

_____ N/A _____ Dollars (\$ _____ N/A _____)

NAME OF BIDDER: _____

ADDRESS OF BIDDER: _____

LOUISIANA CONTRACTOR'S LICENSE NUMBER: _____

NAME OF AUTHORIZED SIGNATORY OF BIDDER: _____

TITLE OF AUTHORIZED SIGNATORY OF BIDDER: _____

SIGNATURE OF AUTHORIZED SIGNATORY OF BIDDER **: _____

DATE: _____

THE FOLLOWING ITEMS ARE TO BE INCLUDED WITH THE SUBMISSION OF THIS LOUISIANA UNIFORM PUBLIC WORK BID FORM:

* The Unit Price Form shall be used if the contract includes unit prices. Otherwise it is not required and need not be included with the form. The number of unit prices that may be included is not limited and additional sheets may be included if needed.

** **A CORPORATE RESOLUTION OR WRITTEN EVIDENCE** of the authority of the person signing the bid for the public work as prescribed by LA R.S. 38:2212(B)(5).

BID SECURITY in the form of a bid bond, certified check or cashier's check as prescribed by LA R.S. 38:2218(A) attached to and made a part of this bid.

LOUISIANA UNIFORM PUBLIC WORK BID FORM

UNIT PRICE FORM

TO: The State of Louisiana – Office of FP&C
1201 N. Third Street, Suite 7-160
Baton Rouge, LA 70802 or
PO Box 94095, Baton Rouge, LA 70804
(Owner to provide name and address of owner)

BID FOR: School of Construction Practice Lab Building
University of Louisiana Monroe
Monroe, LA
Project No. 19-629-23-01, F. 19002614
(Owner to provide name of project and other identifying information)

UNIT PRICES: This form shall be used for any and all work required by the Bidding Documents and described as unit prices. Amounts shall be stated in figures and only in figures.

DESCRIPTION:	<input checked="" type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# __ Fire alarm pull stations shown on drawings			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION <i>(Quantity times Unit Price)</i>
Not Applicable	5	Each		

DESCRIPTION:	<input checked="" type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# __ Access control card reader and door strike			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION <i>(Quantity times Unit Price)</i>
Not Applicable	6	Each		

DESCRIPTION:	<input checked="" type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# __ All brick veneer material as shown in drawings and from spec section 042113			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION <i>(Quantity times Unit Price)</i>
	One (1)	Lump Sum		

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# __			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION <i>(Quantity times Unit Price)</i>

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# __			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION <i>(Quantity times Unit Price)</i>

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# __			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION <i>(Quantity times Unit Price)</i>

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# __			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION <i>(Quantity times Unit Price)</i>

DESCRIPTION:	<input type="checkbox"/> Base Bid or <input type="checkbox"/> Alt.# __			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION <i>(Quantity times Unit Price)</i>

Wording for “DESCRIPTION” is to be provided by the Owner.

All quantities are estimated. The contractor will be paid based upon actual quantities as verified by the Owner.

ADVERTISEMENT FOR BIDS

Sealed bids will be received for the State of Louisiana by the Division of Administration and shall be directed to the Office of Facility Planning and Control, 1201 North Third Street, Claiborne Office Building, Suite 7-160, Baton Rouge, Louisiana, 70802 or P.O. Box 94095, Baton Rouge, Louisiana, 70804-9095. The deadline for receipt of bids is 2:00 PM on **Tuesday, February 24, 2026**, at which time bids will be opened and read aloud in a public meeting in the Claiborne Office Building, Conference Room 1-145.

FOR: **School of Construction Practice Lab Building
University of Louisiana Monroe
Monroe, Louisiana**

PROJECT NUMBER: **19-629-23-01, F.19002614**

Complete Bidding Documents for this project are available in electronic form. They may be obtained without charge and without deposit from **AEPlans (www.aeplans.com)**. Printed copies are not available from the Designer but arrangements can be made to obtain them through most reprographic firms. Plan holders are responsible for their own reproduction costs.

Questions about this procedure shall be directed to the Designer at:

**Timothy M. Brandon Architect, APC
103 Cypress Street
West Monroe, LA 71291
Telephone: 318-340-1550
E-mail: kbrandon@tbastudio.com**

All bids shall be accompanied by bid security in an amount of five percent (5.0%) of the sum of the base bid and all alternates. The form of this security shall be as stated in the Instructions to Bidders included in the Bid Documents for this project.

The successful Bidder shall be required to furnish a Performance and Payment Bond written as described in the Instructions to Bidders included in the Bid Documents for this project.

**A PRE-BID CONFERENCE WILL BE HELD
at 2:00 PM on Tuesday, February 10, 2026 at University of Louisiana Monroe,
School of Construction Building, Auditorium (Room 100), 700 Filhiol Avenue, Monroe, LA 71209.**

Bids shall be accepted from Contractors who are licensed under LA. R.S. 37:2150-2192 for the classification of **Building Construction**. Bidder is required to comply with provisions and requirements of LA R.S. 38:2212(B)(5). No bid may be withdrawn for a period of forty-five (45) days after receipt of bids, except under the provisions of LA. R.S. 38:2214.

The Owner reserves the right to reject any and all bids for just cause. In accordance with La. R.S. 38:2212(B)(1), the provisions and requirements of this Section and those stated in the bidding documents shall not be waived by any entity.

When this project is financed either partially or entirely with State Bonds or financed in whole or in part by federal or other funds which are not readily available at the time bids are received, the award of this Contract is contingent upon the granting of lines of credit, or the sale of bonds by the Bond Commission or the availability of federal or other funds. The State shall incur no obligation to the Contractor until the Contract Between Owner and Contractor is fully executed.

Facility Planning and Control is a participant in the Small Entrepreneurship (SE) Program (the Hudson Initiative) and the Veteran-Owned and Service-Connected Disabled Veteran-Owned (LaVet) Small Entrepreneurships Program. Bidders are encouraged to consider participation. Information is available from the Office of Facility Planning and Control or on its website at <https://www.doa.la.gov/doa/fpc/>.

If you have a disability and would like to request an accommodation in order to participate in this meeting, please contact Cheryl Schilling at Cheryl.Schilling@la.gov or (225) 342-6060 as soon as possible but no later than 48 hours before the scheduled meeting.

STATE OF LOUISIANA
DIVISION OF ADMINISTRATION
FACILITY PLANNING AND CONTROL
MATTHEW H. BAKER, DIRECTOR

BID BOND
FOR
FACILITY PLANNING AND CONTROL PROJECTS

Date: _____

KNOW ALL MEN BY THESE PRESENTS:

That _____ of _____, as Principal, and _____, as Surety, are held and firmly bound unto the State of Louisiana, Division of Administration, Office of Facility Planning and Control (Obligee), in the full and just sum of five (5%) percent of the total amount of this proposal, including all alternates, lawful money of the United States, for payment of which sum, well and truly be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally firmly by these presents.

Surety represents that it is listed on the current U. S. Department of the Treasury Financial Management Service list of approved bonding companies as approved for an amount equal to or greater than the amount for which it obligates itself in this instrument or that it is a Louisiana domiciled insurance company with at least an A - rating in the latest printing of the A. M. Best's Key Rating Guide. If surety qualifies by virtue of its Best's listing, the Bond amount may not exceed ten percent of policyholders' surplus as shown in the latest A. M. Best's Key Rating Guide.

Surety further represents that it is licensed to do business in the State of Louisiana and that this Bond is signed by surety's agent or attorney-in-fact. This Bid Bond is accompanied by appropriate power of attorney.

THE CONDITION OF THIS OBLIGATION IS SUCH that, whereas said Principal is herewith submitting its proposal to the Obligee on a Contract for:

NOW, THEREFORE, if the said Contract be awarded to the Principal and the Principal shall, within such time as may be specified, enter into the Contract in writing and give a good and sufficient bond to secure the performance of the terms and conditions of the Contract with surety acceptable to the Obligee, then this obligation shall be void; otherwise this obligation shall become due and payable.

PRINCIPAL (BIDDER)_____
SURETYBY: _____
AUTHORIZED OFFICER-OWNER-PARTNERBY: _____
AGENT OR ATTORNEY-IN-FACT(SEAL)

July 2021

AIA[®] Document A201[™] – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

School of Construction Practice Lab Building
University of Louisiana Monroe
Monroe, LA

THE OWNER:

(Name, legal status and address)

Facility Planning and Control
P.O. Box 94095
Baton Rouge, LA 70804

THE ARCHITECT:

(Name, legal status and address)

TBA Holdings LLC/dba/TBA Studio
103 Cypress Street
West Monroe, LA 71291

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ADDITIONS AND DELETIONS:

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

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

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

Init.

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(1950958384)

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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 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.

§ 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

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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, 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.

§ 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.

§ 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.

§ 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 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.

§ 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.

§ 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 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 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, 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.

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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, 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:

- .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:

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- .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 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 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.

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§ 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.

§ 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;

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- .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.

§ 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.

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§ 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.

§ 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.

§ 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

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- .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.

§ 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.

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.

§ 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 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.

§ 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.

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, 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.

§ 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 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.

§ 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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Certification of Document's Authenticity

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I, _____, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 15:50:42 ET on 03/05/2019 under Order No. 8779998754 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.

(Signed)

(Title)

(Dated)

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions modify, change, delete from or add to the General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition. Where any Article of the General Conditions is modified or any Section, Paragraph, Subparagraph or Clause thereof is modified or deleted by these supplements, the unaltered provisions of that Section, Article, Paragraph, Subparagraph or Clause shall remain in effect.

Articles, Sections, Paragraphs, Subparagraphs or Clauses modified or deleted have the same numerical designation as those occurring in the General Conditions.

ARTICLE 1

GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1. The Contract Documents

In Section 1.1.1 delete the third sentence, and add the following sentence:

The Contract Documents shall include the Bid Documents as listed in the Instructions to Bidders and any modifications made thereto by addenda.

1.1.8 Initial Decision Maker

Delete all after the words, “shall not show partiality to the Owner or Contractor”.

1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE [REFER TO *La R.S. 38:2317*]

1.5.1 Delete the first sentence of the paragraph.

1.5.1 In the third sentence: delete the remainder after the word “publication”.

1.7 DIGITAL DATA USE AND TRANSMISSION

In the first sentence after the words, “in digital form” delete “. The parties will use AIA Document E203 2013, Building Information Modeling and Digital Data Exhibit”.

1.8 BUILDING INFORMATION MODELS USE AND RELIANCE

Delete Section 1.8.

ARTICLE 2

OWNER

2.2 EVIDENCE OF THE OWNER’S FINANCIAL ARRANGEMENTS

Delete Section 2.2.

2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.3.1 In the first sentence, delete: all before “the Owner shall secure...”

Delete Section 2.3.2 and substitute the following:

2.3.2 The term Architect, when used in the Contract Documents, shall mean the prime Designer (Architect, Engineer, or Landscape Architect), or his authorized representative, lawfully licensed to practice architecture, engineering, or landscape architecture in the State of Louisiana, identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number.

2.3.3 Delete the words: “to whom the Contractor has no reasonable objection and”.

ARTICLE 3**CONTRACTOR****3.4 LABOR AND MATERIALS**

3.4.2 Delete Section 3.4.2.

Delete Section 3.4.3 and substitute with the following:

3.4.3 Contractor and its employees, officers, agents, representatives, and Subcontractors shall conduct themselves in an appropriate and professional manner, in accordance with the Owner’s requirements, at all times while working on the Project. Any such individual who behaves in an inappropriate manner or who engages in the use of inappropriate language or conduct while on Owner’s property, as determined by the Owner, shall be removed from the Project at the Owner’s request. Such individual shall not be permitted to return without the written permission of the Owner. The Owner shall not be responsible or liable to Contractor or any Subcontractor for any additional costs, expenses, losses, claims or damages incurred by Contractor or its Subcontractor as a result of the removal of an individual from the Owner’s property pursuant to this Section. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

3.5 WARRANTY

3.5.2 Replace reference to “Section 9.8.4” with “Section 9.8.6”.

3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS (La R.S. 40:1724[A])

3.7.1 Delete Section 3.7.1.

3.7.2 In Section 3.7.2, replace the word “public” with the word “State”.

Delete Section 3.7.5 and substitute the following:

- 3.7.5 If, during the course of the Work, the Contractor discovers human remains, unmarked burial or archaeological sites, burial artifacts, or wetlands, which are not indicated in the Contract Documents, the Contractor shall follow all procedures mandated by State and Federal law, including but not limited to La R.S. 8:671 et seq., the Office of Coastal Protection and Restoration, and Sections 401 & 404 of the Federal Clean Water Act. Request for adjustment of the Contract Sum and Contract Time arising from the existence of such remains or features shall be submitted in writing to the Owner pursuant to the Contract Documents.

3.8 ALLOWANCES

Delete Sections 3.8.1, 3.8.2, and 3.8.3 in their entirety and add the following new Section 3.8.1:

- 3.8.1 Allowances shall not be made on any of the Work.

3.9 SUPERINTENDENT

- 3.9.1 Add the following to the end of the paragraph:
Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

3.10 CONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES

- 3.10.1 Add the following: For projects with a contract sum greater than \$1,000,000.00, the Contractor shall include with the schedule, for the Owner's and Architect's information, a network analysis to identify those tasks which are on the critical path, i.e., where any delay in the completion of these tasks will lengthen the project timescale, unless action is taken. A revised schedule shall be submitted with each Application and Certificate for Payment. No payment shall be made until this schedule is received.

- 3.10.3 In the first sentence, delete the word "general".

After the first sentence, add the following:

If the Work is not on schedule, as determined by the Architect, and the Contractor fails to take action to bring the Work on schedule, then the Contractor shall be deemed in default under this Contract and the progress of the Work shall be deemed unsatisfactory. Such default may be considered grounds for termination by the Owner for cause in accordance with Section 14.2.

Add the following Sections:

- 3.10.4 Add the following: Submittal by the contractor of a schedule or other documentation showing a completion date for his Work prior to the completion date stated in the contract shall not impose any obligation or responsibility on the Owner or Architect for the earlier completion date.
- 3.10.5 In the event the Owner employs a commissioning consultant, the Contractor shall cooperate fully in the commissioning process and shall require all subcontractors and

others under his control to cooperate. The purpose of such services shall be to ensure that all systems perform correctly and interactively according to the provisions of the Contract Documents.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add the following: This requirement is of the essence of the contract. The Architect shall determine the value of these documents and this amount shall not be approved for payment to the Contractor until all of the listed documents are delivered to the Architect in good order, completely marked with field changes and otherwise complete in all aspects.

ARTICLE 4

ARCHITECT

4.2 ADMINISTRATION OF THE CONTRACT

4.2.1 In the first sentence, delete the phrase: “the date the Architect issues the final Certificate for Payment” and replace with the phrase “final payment is due, and with the Owner’s concurrence, from time to time during the one year period for correction of Work described in Section 12.2.”

4.2.2 In the first sentence, after the phrase: “become generally familiar with”; insert the following: “and to keep the Owner informed about”.

In the first sentence, after the phrase “portion of the Work completed”, insert the following: “to endeavor to guard the Owner against defects and deficiencies in the Work,”

4.2.4 In the first sentence, delete all after “The Owner and Contractor”, and add the following “may communicate directly with each other, when deemed necessary by the Owner, and the Owner will notify the Architect of any decision.”

4.2.10 Add the following sentence to the end of Section 4.2.10: There shall be no restriction on the Owner having a Representative.

4.2.11 Add the following sentence to the end of Section 4.2.11:

If no agreement is made concerning the time within which interpretation required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretation until 15 days after written request is made for them.

4.2.14 Insert the following sentence between the second and third sentences of Section 4.2.14:

If no agreement is made concerning the time within which interpretation required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretation until 15 days after written request is made for them.

ARTICLE 5**SUBCONTRACTORS****5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK**

Delete Section 5.2.1, and substitute the following:

- 5.2.1 Unless otherwise required by the Contract Documents, the Contractor shall furnish at the Pre-Construction Conference, to the Owner and the Architect, in writing, the names of the persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each of the principal portions of the Work. No Contractor payments shall be made until this information is received.

Delete Section 5.2.2, and substitute the following:

- 5.2.2 The Contractor shall be solely responsible for selection and performance of all subcontractors. The Contractor shall not be entitled to claims for additional time and/or an increase in the contract sum due to a problem with performance or nonperformance of a subcontractor.

Delete Sections 5.2.3 and 5.2.4 and substitute the following:

- 5.2.3 The Contractor shall notify the Architect and the Owner when a subcontractor is to be changed and substituted with another subcontractor.

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

Delete Sections 5.4, 5.4.1, 5.4.2 and 5.4.3

ARTICLE 7**CHANGES IN THE WORK****7.1 GENERAL**

Add the following Sections:

- 7.1.4 As part of the pre-construction conference submittals, the Contractor shall submit the following prior to the Contractor's initial request for payment:
- 7.1.4.1 Fixed job site overhead cost itemized with documentation to support daily rates.
 - 7.1.4.2 Bond Premium Rate with supporting information from the General Contractor's carrier.

7.1.4.3 Labor Burden by trade for both Subcontractors and General Contractor. The Labor Burden shall be supported by the Worker's Compensation and Employer's Liability Insurance Policy Information Page. Provide for all trades.

7.1.4.4 Internal Rate Charges for all significant company owned equipment.

7.1.5 If the General Contractor fails to submit the aforementioned documentation as part of the pre-construction submittals, then pay applications shall not be processed until such time as the Owner receives this information.

7.2 CHANGE ORDERS

Delete Section 7.2.1, and substitute the following Sections:

7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, the Architect, and the Contractor issued after execution of the Contract, authorizing a change in the Work and/or an adjustment in the Contract Sum and/or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment in the Contract Sum or the Contract Time. Any reservation of rights, stipulation, or other modification made on the change order by the contractor shall have no effect.

7.2.2 "Cost of the Work" for the purpose of Change Orders shall be the eligible costs required to be incurred in performance of the Work and paid by the Contractor and Subcontractors which eligible costs shall be limited to:

7.2.2.1 Actual wages paid directly to labor personnel, with a labor burden markup exclusively limited to applicable payroll taxes, worker's compensation insurance, unemployment compensation, and social security taxes for those labor personnel performing the Work. Wages shall be the basic hourly labor rate paid an employee exclusive of fringe benefits or other employee costs. The labor burden percentage for the "Cost of the Work" is limited to categories listed herein. Employer-provided health insurance, fringe benefits, employee training (whether a requirement of employment or not), vacation pay, etc., are examples of ineligible labor burden costs which **shall not** be included, as these costs are already compensated by the Overhead and Profit markup.

Supervision shall not be included as a line item in the "Cost of the Work", except when the change results in a documented delay in the critical path, as described in Section 7.2.7.

7.2.2.2 Cost of all materials and supplies necessary and required to perform the Work, identifying each item and its individual cost, including taxes. Incidental consumables are not eligible costs and shall not be included.

7.2.2.3 Cost of each necessary piece of machinery and equipment required to perform the Work, identifying each item and its individual cost, including taxes. Incidental small tools of a specific trade (i.e., shovels, saws, hammers, air compressors, etc.,) and general use vehicles, such as pickup trucks even for

moving items around the site, fuel for these general use vehicles, travel, lodging, and/or meals are not eligible and shall not be included.

7.2.2.4 Eligible Insurance costs shall be limited to documented increases in “Builder’s Risk” insurance premium / costs only. Commercial General Liability, Automobile Liability, and all other required insurances, where referenced in the Contract shall be considered part of normal overhead. These costs are already compensated by the Overhead and Profit markup.

7.2.2.5 Cost for the General Contractor Performance and Payment Bond premium, where the documented cost of the premiums have been increased due to the Change Order.

7.2.3 Overhead and Profit - The Contractor and Subcontractor shall be due home office fixed overhead and profits on the Cost of the Work, but shall not exceed a total of 16% of the direct cost of any portion of Work.

The credit to the Owner resulting from a change in the Work shall be the sum of those items above, including overhead and profit. Where a change results in both credits to the Owner and extras to the Contractor for related items, overhead and profit shall be computed for credits to the Owner and extras to the Contractor. The Owner shall receive full credit for the computed overhead and profit on credit change order items.

7.2.4 The cost to the Owner resulting from a change in the Work shall be the sum of: Cost of the Work (as defined at Section 7.2.2) and Overhead and Profit (as defined at Section 7.2.3), and shall be computed as follows:

7.2.4.1 When all of the Work is General Contractor Work; 8% markup on the Cost of the Work.

7.2.4.2 When the Work is all Subcontract Work; 8% markup on the Cost of the Work for Subcontractor’s Overhead and Profit, plus 8% markup on the Cost of the Work, not including the Subcontractor’s Overhead and Profit markup, for General Contractor’s Overhead and Profit.

7.2.4.3 When the Work is a combination of General Contractor Work and Subcontract Work; that portion of the direct cost that is General Contract Work shall be computed per Section 7.2.4.1 and that portion of the direct cost that is Subcontract Work shall be computed per Section 7.2.4.2.

Premiums for the General Contractor’s bond may be included, but after the markup is added to the Cost of the Work.

Premiums for the Subcontractor’s Bond shall not be included.

7.2.4.4 Subcontract cost shall consist of the items in Section 7.2.2 above plus Overhead and Profit as defined in Section 7.2.3.

7.2.5 Before a Change Order is prepared, the Contractor shall prepare and deliver to the Architect the following information concerning the Cost of the Work, not subject to waiver, within a reasonable time after being notified to prepare said Change Order:

A detailed, itemized list of labor, material and equipment costs for the General Contractor's Work including quantities and unit costs for each item of labor, material and equipment.

An itemized list of labor, material and equipment costs for each Subcontractor's and/or Sub-Subcontractor's Work including quantities and unit costs for each item of labor, material and equipment.

- 7.2.6 After a Change Order has been approved, no future requests for extensions of time or additional cost shall be considered for that Change Order.

- 7.2.7 Extended fixed job-site costs are indirect costs that are necessary to support the work in the field. Examples of fixed job-site costs are field office rental, salaries of field office staff, field office utilities, and telephone.

Extended fixed job-site costs or equitable adjustment may be included in a Change Order due to a delay in the critical path, with the exception of weather related delays. In the event of a delay in the critical path, the Contractor shall submit all changes or adjustments to the Contract Time **within twenty-one (21) days** of the event giving rise to the delay. The Contractor shall submit documentation and justification for the adjustment by performing a critical path analysis of its most recent schedule in use prior to the change, which shows an extension in critical path activities.

The Contractor shall notify the Architect in writing that the Contractor is making a claim for extended fixed job-site overhead as required by Section 15.1.2. The Contractor shall provide proof that the Contractor is unable to mitigate financial damages through Alternate Work within this Contract or replacement work. "Replacement Work" is that work which the Contractor is obligated to perform under any construction contract separate from this Contract. Reasonable proof shall be required by the Architect that the delays affected the Completion Date.

- 7.2.8 "Cost of the Work" whether General Contractor cost or Subcontractor cost shall not apply to the following:

7.2.8.1 Salaries or other compensation of the Contractor's personnel at the Contractor's principal office and branch offices.

7.2.8.2 Any part of the Contractor's capital expenses, including interest on the Contractor's capital employed for the Work.

7.2.8.3 Overhead and general expenses of any kind or the cost of any item not specifically and expressly included above in Cost of the Work.

7.2.8.4 Cost of supervision refer to section 7.2.2.1, with exception as provided in Section 7.2.7.

- 7.2.9 When applicable as provided by the Contract, the cost to Owner for Change Orders shall be determined by quantities and unit prices. The quantity of any item shall be as

submitted by the Contractor and approved by the Architect. Unit prices shall cover cost of Material, Labor, Equipment, Overhead and Profit.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.3 In the first sentence after “following methods” insert: “, but not to exceed a specified amount”.

7.3.4 From .1 of the list, delete all after “Costs of labor, including” and substitute the following “social security, old age and employment insurance, applicable payroll taxes, and workers’ compensation insurance;”

Delete the following from .4 of the list: “permit fees,”

Delete Section 7.3.9 and substitute the following:

7.3.9 Pending final determination of the total costs of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by a Change Order indicating the parties’ agreement with part or all of such costs.

ARTICLE 8

TIME

8.1 DEFINITIONS

Add the following:

8.1.5 The Contract Time shall not be changed by the submission of a schedule that shows an early completion date unless specifically authorized by change order.

8.2 PROGRESS AND COMPLETION

Add to Section 8.2.1 the following:

Completion of the Work must be within the Time for Completion stated in the Agreement, subject to such extensions as may be granted under Section 8.3. The Contractor agrees to commence Work not later than fourteen (14) days after the transmittal date of Written Notice to Proceed from the Owner and to substantially complete the project within the time stated in the Contract. The Owner will suffer financial loss if the project is not substantially complete in the time set forth in the Contract Documents. The Contractor and the Contractor’s Surety shall be liable for and shall pay to the Owner the sum stated in the Contract Documents as fixed, agreed and liquidated damages for each consecutive calendar day (Saturdays, Sundays and holidays included) of delay until the Work is substantially complete. The Owner shall be entitled to the sum stated in the Contract Documents. Such Liquidated Damages shall be withheld by the Owner from the amounts due the Contractor for progress payments.

Delete Section 8.2.2.

8.3 DELAYS AND EXTENSIONS OF TIME

- 8.3.1 In the first sentence after the words “Owner pending” delete the words “mediation and binding dispute resolution” and add the word “litigation”, and delete the last word “determine” and add the following: “recommend, subject to Owner’s approval of Change Order. If the claim is not made within the limits of Article 15, all rights for future claims for that month are waived.”

ARTICLE 9**PAYMENTS AND COMPLETION****9.1 CONTRACT SUM**

Delete Section 9.1.2.

Delete Section 9.2 and substitute the following:

9.2 SCHEDULE OF VALUES

At the Pre-Construction Conference, the Contractor shall submit to the Owner and the Architect a Schedule of Values prepared as follows:

- 9.2.1 The attached Schedule of Values Format shall be used. If applicable, the cost of Work for each section listed under each division, shall be given. The cost for each section shall include Labor, Materials, Overhead and Profit.
- 9.2.2 The Total of all items shall equal the Total Contract Sum. This schedule, when approved by the Architect, shall be used as a basis for the Contractor’s Applications for Payment and it may be used for determining the cost of the Work in deductive change orders, when a specific item of Work listed on the Schedule of Values is to be removed. Once the Schedule of Values is submitted at the Pre-Construction Conference, the schedule shall not be modified without approval from the Owner and Architect.

9.3 APPLICATIONS FOR PAYMENT

Delete Sections 9.3.1, 9.3.1.1, and 9.3.1.2 and substitute the following:

- 9.3.1 Monthly, the Contractor shall submit to the Architect a Facility Planning and Control – Application and Certification for Payment form, supported by any additional data substantiating the Contractor’s right to payment as the Owner or the Architect may require. Application for Payment shall be submitted on or about the first of each month for the value of labor and materials incorporated into the Work and of materials, suitably stored, at the site as of the twenty-fifth day of the preceding month, less normal retainage as follows, per La R.S. 38:2248:

9.3.1.1 Projects with Contract price up to \$500,000.00 – 10% of the Contract price.

9.3.1.2 Projects with Contract price of \$500,000.00, or more – 5% of the Contract price.

9.3.1.3 No payment shall be made until the revised schedule required by Section 3.10.1 is received.

9.3.1.4 The normal retainage shall not be due the Contractor until after substantial completion and expiration of the forty-five day lien period and submission to the Architect of a clear lien certificate, consent of surety, and invoice for retainage.

Delete Section 9.3.2 and substitute the following:

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. Payments for materials or equipment stored on the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, including applicable insurance.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

Section 9.5.1.7: Delete the word "repeated".

Delete Section 9.5.4.

9.6 PROGRESS PAYMENTS

Delete Section 9.6.1 and substitute the following:

9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment within twenty days except for projects funded fully or in part by a Federal reimbursement program. For such projects the Owner will make payment in a timely manner consistent with reimbursement.

9.6.2 Delete the phrase: "no later than seven days" from the first sentence.

After the end of the second sentence, add the following:

La R.S. 9:2784 (A) and (C) require a Contractor or Subcontractor to make payment due to each Subcontractor and supplier within fourteen (14) consecutive days of the receipt of payment from the Owner. If not paid, a penalty in the amount of ½ of 1% per day is due, up to a maximum of 15% from the expiration date until paid. The contractor or subcontractor, whichever is applicable, is solely responsible for payment of a penalty.

9.6.4 Delete the first two sentences of Section 9.6.4 and add the following to the end of the Section:

Pursuant to La. R.S. 38:2242 and La. R.S. 38:2242.2, when the Owner receives any claim of nonpayment arising out of the Contract, the Owner shall deduct 125% of such claim from the Contract Sum. The Contractor, or any interested party, may deposit security, in accordance with La. R.S. 38:2242.2, guaranteeing payment of the claim with the recorder

of mortgages of the parish where the Work has been done. When the Owner receives original proof of such guarantee from the recorder of mortgages, the claim deduction will be added back to the Contract Sum.

Delete Section **9.7 FAILURE OF PAYMENT.**

Delete Section 9.8 and substitute the following:

9.8 SUBSTANTIAL COMPLETION

- 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The Architect shall determine if the project is substantially complete in accordance with this Section.
- 9.8.2 When the Contractor considers that the Work 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 shall make an inspection to determine whether the Work is substantially complete. A prerequisite to the Work being considered as substantially complete is the Owner's receipt of the executed Roofing Contractor's and Roofing Manufacturer's guarantees, where roofing Work is part of the Contract. Prior to inspection by the Architect, the Contractor shall notify the Architect that the project is ready for inspection by the State Fire Marshal's office. 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 for its intended use, the Contractor shall, before the Work can be considered as Substantially Complete, 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 Architect determines that the project is Substantially Complete, he shall prepare a punch list of exceptions and the dollar value related thereto. The monetary value assigned to this list will be the sum of the cost estimate for each particular item of Work the Architect develops based on the mobilization, labor, material and equipment costs of correcting the item and shall be retained from the monies owed the contractor, above and beyond the standard lien retainage. The cost of these items shall be prepared in the same format as the schedule of values. At the end of the forty-five day lien period payment shall be approved for all punch list items completed up to that time. After that payment, none of the remaining funds shall be due the contractor until all punch list items are completed and are accepted by the Architect. If the dollar value of the punch list exceeds the amount of funds, less the retainage amount, in the remaining balance of the Contract, then the Project shall not be considered as substantially complete. If funds remaining are less than that required to complete the Work, the Contractor shall pay the difference.

- 9.8.5 When the preparation of the punch list is complete the Architect shall prepare a Recommendation of Acceptance incorporating the punch list and submit it to the Owner. Upon approval of the Recommendation of Acceptance, the Owner may issue a Notice of Acceptance of Building Contract which shall establish the Date of Substantial Completion. The Contractor shall record the Notice of Acceptance with the Clerk of Court in the Parish in which the Work has been performed. If the Notice of Acceptance has not been recorded seven (7) days after issuance, the Owner may record the Acceptance at the Contractor's expense. All additive change orders must be processed before issuance of the Recommendation of Acceptance. The Owner shall not be responsible for payment for any Work associated with change orders that is not incorporated into the contract at the time of the Recommendation of Acceptance.
- 9.8.6 Warranties required by the Contract Documents shall commence on the date of Acceptance of the Work unless otherwise agreed to in writing by the Owner and Contractor. Unless otherwise agreed to in writing by the Owner and Contractor, security, maintenance, heat, utilities, damage to the Work not covered by the punch list and insurance shall become the Owner's responsibility on the Date of Substantial Completion.
- 9.8.7 If all punch list items have not been completed by the end of the forty-five (45) day lien period, through no fault of the Architect or Owner, the Owner may hold the Contractor in default. If the Owner finds the Contractor is in default, the Surety shall be notified. If within forty-five (45) days after notification, the Surety has not completed the punch list, through no fault of the Architect or Owner, the Owner may, at his option, contract to have the balance of the Work completed and pay for such Work with the unpaid funds remaining in the Contract sum. Finding the Contractor in default shall constitute a reason for disqualification of the Contractor from bidding on future state contracts. If the surety fails to complete the punch list within the stipulated time period, the Owner may not accept bonds submitted, in the future, by the surety.

9.9 PARTIAL OCCUPANCY OR USE

Delete Section 9.9.1 and substitute the following:

- 9.9.1 Partial Occupancy is that stage in the progress of the Work when a designated portion of the Work is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the designated portion of the Work for its intended use. The Owner may occupy or use any substantially completed portion of the Work so designated by separate agreement with the Contractor and authorized by public authorities having jurisdiction over the Work. Such occupancy or use may commence provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, 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 the designated 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.

9.10 FINAL COMPLETION AND FINAL PAYMENT

Delete Section 9.10.4 and replace with the following:

9.10.4 The making of final payment shall not constitute a waiver of Claims by the Owner for the following:

9.10.4.1 Claims, security interests, or encumbrances arising out of the Contract and unsettled;

9.10.4.2 failure of the Work to comply with the requirements of the Contract Documents irrespective of when such failure is discovered;

9.10.4.3 terms of special warranties required by the Contract Documents; or

9.10.4.4 audits performed by the Owner, after final payment.

ARTICLE 10

PROTECTION OF PERSONS AND PROPERTY

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.2 In the first sentence, between the words: “bearing on” and “safety”, add the words: “the health and,”

10.3 HAZARDOUS MATERIALS

10.3.1 In the second sentence after (PCB) add: “or lead”.

10.3.2 After the first sentence, delete all remaining sentences.

Add at the end: “The Contract time shall be extended appropriately.”

Delete Section 10.4 and substitute the following:

10.4 EMERGENCIES

In an emergency affecting the safety of persons or property, the Contractor shall notify the Owner and Architect immediately of the emergency, simultaneously acting at his discretion to prevent damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency Work shall be determined as provided in Article 15 and Article 7.

ARTICLE 11

INSURANCE AND BONDS

AIA A101 – 2017 Exhibit A is not a part of these documents. Delete all of Sections 11.1, 11.2, 11.3, 11.4, and 11.5, and substitute the following:

INSURANCE REQUIREMENTS FOR NEW CONSTRUCTION, ADDITIONS AND RENOVATIONS

11.1 CONTRACTOR'S LIABILITY INSURANCE

The Contractor shall purchase and maintain without interruption for the duration of the contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the Work hereunder by the Contractor, its agents, representatives, employees or subcontractors. The duration of the contract shall be from the inception of the contract until the date of final payment.

11.2 MINIMUM SCOPE AND LIMITS OF INSURANCE

11.2.1 Worker's Compensation

Worker's Compensation insurance shall be in compliance with the Worker's Compensation law of the Contractor's headquarters. Employers Liability is included with a minimum limit of \$1,000,000 per accident/per disease/per employee. If Work is to be performed over water and involves maritime exposure, applicable LHWCA, Jones Act or other maritime law coverage shall be included. A.M. Best's insurance company rating requirement may be waived for Worker's compensation coverage only.

11.2.2 Commercial General Liability

Commercial General Liability insurance, including Personal and Advertising Injury Liability and Products and Completed Operations Liability, shall have a minimum limit per occurrence based on the project value. The Insurance Services Office (ISO) Commercial General Liability occurrence coverage form CG 00 01 (current form approved for use in Louisiana), or equivalent, is to be used in the policy. Claims-made form is unacceptable.

The aggregate loss limit must apply to each project. ISO form CG 25 03 (current form approved for use in Louisiana), or equivalent, shall also be submitted. The State project number, including part number, and project name shall be included on this endorsement.

COMBINED SINGLE LIMIT (CSL) PER OCCURRENCE

<u>Type of Construction</u>	<u>Projects up to \$1,000,000</u>	<u>Projects over \$1,000,000 up to \$10,000,000</u>	<u>Projects over \$10,000,000</u>
New Buildings:			
Each Occurrence Minimum Limit	\$1,000,000	\$2,000,000	\$4,000,000
Per Project Aggregate	\$2,000,000	\$4,000,000	\$8,000,000
Renovations:			
	The building(s) value for the Project is <u>\$4,800,865.00</u>.		
Each Occurrence Minimum Limit	\$1,000,000**	\$2,000,000**	\$4,000,000**

Per Project Aggregate	2 times per occur limit**	2 times per occur limit**	2 times per occur limit**
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**While the minimum Combined Single Limit of \$1,000,000 is required for any renovation, the limit is calculated by taking 10% of the building value and rounding it to the nearest \$1,000,000 to get the insurance limit. Example: Renovation on a \$33,000,000 building would have a calculated \$3,300,000 combined single limit of coverage ($33,000,000 \times .10 = 3,300,000$ and then rounding down to \$3,000,000). If the calculated limit is less than the minimum limit listed in the above chart, then the amount needed is the minimum listed in the chart. Maximum per occurrence limit required is \$10,000,000 regardless of building value. The per project aggregate limit is then calculated as twice the per occurrence limit.

11.2.3 Automobile Liability

Automobile Liability Insurance shall have a minimum combined single limit per occurrence of \$1,000,000. ISO form number CA 00 01 (current form approved for use in Louisiana), or equivalent, is to be used in the policy. This insurance shall include third-party bodily injury and property damage liability for owned, hired and non-owned automobiles.

11.2.4 Excess Umbrella

Excess Umbrella Insurance may be used to meet the minimum requirements for General Liability and Automobile Liability only.

11.2.5 Builder's Risk

11.2.5.1 Builder's Risk Insurance shall be in an amount equal to the amount of the construction contract including any amendments and shall be upon the entire Work included in the contract. The policy shall provide coverage equivalent to the ISO form number CP 10 20, Broad Form Causes of Loss (extended, if necessary, to include the perils of wind, earthquake, collapse, vandalism/malicious mischief, and theft, including theft of materials whether or not attached to any structure). The policy must include architects' and engineers' fees necessary to provide plans, specifications and supervision of Work for the repair and/or replacement of property damage caused by a covered peril, not to exceed 10% of the cost of the repair and/or replacement.

11.2.5.2 Flood coverage shall be provided by the Contractor on the first floor and below for all projects, except as otherwise noted. The builder's risk insurance policy, sub-limit for flood coverage shall not be less than ten percent (10%) of the total contract cost per occurrence. If flood is purchased as a separate policy, the limit shall be ten percent (10%) of the total contract cost per occurrence (with a max of \$500,000 if NFIP). Coverage for roofing projects shall **not** require flood coverage.

11.2.5.3 A Specialty Contractor may provide an installation floater in lieu of a Builder's Risk policy, with the similar coverage as the Builder's Risk policy, upon the

system to be installed in an amount equal to the amount of the contract including any amendments. Flood coverage is not required.

11.2.5.4 The policy must include coverage for the Owner, Contractor and any subcontractors as their interests may appear.

11.2.6 Pollution Liability (*required when asbestos or other hazardous material abatement is included in the contract*)

Pollution Liability insurance, including gradual release as well as sudden and accidental, shall have a minimum limit of not less than \$1,000,000 per claim. A claims-made form will be acceptable. A policy period inception date of no later than the first day of anticipated Work under this contract and an expiration date of no earlier than 30 days after anticipated completion of all Work under the contract shall be provided. There shall be an extended reporting period of at least 24 months, with full reinstatement of limits, from the expiration date of the policy if the policy is not renewed. The policy shall not be cancelled for any reason, except non-payment of premium.

11.2.7 Deductibles and Self-Insured Retentions

Any deductibles or self-insured retentions must be declared to and accepted by the Owner. The Contractor shall be responsible for all deductibles and self-insured retentions.

11.3 OTHER INSURANCE PROVISIONS

11.3.1 The policies are to contain, or be endorsed to contain, the following provisions:

11.3.1.1 Worker's Compensation and Employers Liability Coverage

11.3.1.1.1 To the fullest allowed by law, the insurer shall agree to waive all rights of subrogation against the Owner, its officers, agents, employees and volunteers for losses arising from Work performed by the Contractor for the Owner.

11.3.1.2 Commercial General Liability Coverage

11.3.1.2.1 The Owner, its officers, agents, employees and volunteers are to be added as additional insureds as respects liability arising out of activities performed by or on behalf of the Contractor; products and completed operations of the Contractor, premises owned, occupied or used by the Contractor. ISO Form CG 20 10 (for ongoing work) AND CG 20 37 (for completed work) (current forms approved for use in Louisiana), or equivalent, are to be used.

11.3.1.2.2 The Contractor's insurance shall be primary as respects the Owner, its officers, agents, employees and volunteers for any and all losses that occur under the contract. The coverage shall contain no special limitations on the scope of protection afforded to the Owner, its officers, officials, employees or volunteers. Any insurance or self-

insurance maintained by the Owner shall be excess and non-contributory of the Contractor's insurance.

11.3.1.3 Builder's Risk

The policy must include an endorsement providing the following:

In the event of a disagreement regarding a loss covered by this policy, which may also be covered by a State of Louisiana self-insurance or commercial property policy through the Office of Risk Management (ORM), Contractor and its insurer agree to follow the following procedure to establish coverage and/or the amount of loss:

Any party to a loss may make written demand for an appraisal of the matter in disagreement. Within 20 days of receipt of written demand, the Contractor's insurer and either ORM or its commercial insurance company shall each select a competent and impartial appraiser and notify the other of the appraiser selected. The two appraisers shall select a competent and impartial umpire. The appraisers shall then identify the policy or policies under which the loss is insured and, if necessary, state separately the value of the property and the amount of the loss that must be borne by each policy. If the two appraisers fail to agree, they shall submit their differences to the umpire. A written decision by any two shall determine the policy or policies and the amount of the loss. Each insurance company agrees that the decision of the appraisers and the umpire if involved shall be binding and final and that neither party will resort to litigation. Each of the two parties shall pay its chosen appraiser and bear the cost of the umpire equally.

11.3.1.4 All Coverages

11.3.1.4.1 All policies must be endorsed to require 30 days written notice of cancellation to the Agency. Ten-day written notice of cancellation is acceptable for non-payment of premium. Notifications shall comply with the standard cancellation provisions in the Contractor's policy. In addition, Contractor is required to notify Agency of policy cancellations or reductions in limits.

11.3.1.4.2 Neither the acceptance of the completed Work nor the payment thereof shall release the Contractor from the obligations of the insurance requirements or indemnification agreement.

11.3.1.4.3 The insurance companies issuing the policies shall have no recourse against the Owner for payment of premiums or for assessments under any form of the policies.

11.3.1.4.4 Any failure of the Contractor to comply with reporting provisions of the policy shall not affect coverage provided to the Owner, its officers, agents, employees and volunteers.

11.3.2 Acceptability of Insurers

All required insurance shall be provided by a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located. Insurance shall be placed with insurers with an A.M. Best's rating of **A-: VI or higher**. This rating requirement may be waived for Worker's compensation coverage only.

If at any time an insurer issuing any such policy does not meet the minimum A.M. Best rating, the Contractor shall obtain a policy with an insurer that meets the A.M. Best rating and shall submit another certificate of insurance within 30 days.

11.3.3 Verification of Coverage

Contractor shall furnish the Owner with Certificates of Insurance reflecting proof of required coverage. The Certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. The Certificates are to be received and approved by the Owner before Work commences and upon any contract renewal or insurance policy renewal thereafter. The Certificate Holder must be listed as follows:

State of Louisiana

Name of Owner

Owner Address

City, State, Zip

Attn: Project # _____

The Owner reserves the right to request complete certified copies of all required insurance policies at any time.

Upon failure of the Contractor to furnish, deliver and maintain required insurance, this contract, at the election of the Agency, may be suspended, discontinued, or terminated. Failure of the Contractor to purchase and/or maintain any required insurance shall not relieve the Contractor from any liability or indemnification under the contract.

If the Contractor does not meet the insurance requirements at policy renewal, at the option of the Owner, payment to the Contractor may be withheld until the requirements have been met, OR the Owner may pay the renewal premium and withhold such payment from any monies due the Contractor, OR the contract may be suspended or terminated for cause.

11.3.4 Subcontractors

Contractor shall include all subcontractors as insureds under its policies OR shall be responsible for verifying and maintaining the certificates provided by each subcontractor. Subcontractors shall be subject to all of the requirements stated herein. The Owner reserves the right to request copies of subcontractor's certificates at any time.

If Contractor does not verify subcontractors' insurance as described above, Owner has the right to withhold payments to the Contractor until the requirements have been met.

11.3.5 Worker's Compensation Indemnity

In the event Contractor is not required to provide or elects not to provide Worker's compensation coverage, the parties hereby agree the Contractor, its Owners, agents and employees shall have no cause of action against, and shall not assert a claim against, the State of Louisiana, its departments, agencies, agents and employees as an employer, whether pursuant to the Louisiana Worker's Compensation Act or otherwise, under any circumstance. The parties also hereby agree that the State of Louisiana, its departments, agencies, agents and employees shall in no circumstance be, or considered as, the employer or statutory employer of Contractor, its Owners, agents and employees. The parties further agree that Contractor is a wholly independent Contractor and is exclusively responsible for its employees, Owners, and agents. Contractor hereby agrees to protect, defend, indemnify and hold the State of Louisiana, its departments, agencies, agents and employees harmless from any such assertion or claim that may arise from the performance of this contract.

11.3.6 Indemnification/Hold Harmless Agreement

Contractor agrees to protect, defend, indemnify, save, and hold harmless, the State of Louisiana, all State Departments, Agencies, Boards and Commissions, its officers, agents, servants, employees and volunteers, from and against any and all claims, damages, expenses and liability arising out of injury or death to any person or the damage, loss or destruction of any property which may occur, or in any way grow out of, any act or omission of Contractor, its agents, servants and employees, or any and all costs, expenses and/or attorney fees incurred by Contractor as a result of any claims, demands, suits or causes of action, except those claims, demands, suits or causes of action arising out of the negligence of the State of Louisiana, all State Departments, Agencies, Boards, Commissions, its officers, agents, servants, employees and volunteers.

Contractor agrees to investigate, handle, respond to, provide defense for and defend any such claims, demands, suits or causes of action at its sole expense and agrees to bear all other costs and expenses related thereto, even if the claims, demands, suits, or causes of action are groundless, false or fraudulent. The State of Louisiana may, but is not required to, consult with the Contractor in the defense of claims, but this shall not affect the Contractor's responsibility for the handling and expenses of all claims.

11.4 PERFORMANCE AND PAYMENT BOND

- 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.
- 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.
- 11.4.3 Recordation of Contract and Bond [La R.S. 38:2241 thru 38:2241.1]

The Owner shall record within thirty (30) days the Contract Between Owner and Contractor and Performance and Payment Bond with the Clerk of Court in the Parish in which the Work is to be performed.

ARTICLE 12

UNCOVERING AND CORRECTION OF WORK

12.2 CORRECTION OF WORK

12.2.1 Before Substantial Completion

At the end of the paragraph, add the following sentences:

“If the Contractor fails to correct Work identified as defective within a thirty (30) day period, through no fault of the Designer, the Owner may hold the Contractor in default. If the Owner finds the Contractor in default, the Surety shall be notified. If within thirty (30) days after notification, the Surety has not corrected the nonconforming Work, through no fault of the Architect or Owner, the Owner may contract to have nonconforming Work corrected and hold the Surety and Contractor responsible for the cost, including architectural fees and other indirect costs. If the Surety fails to correct the Work within the stipulated time period and fails to meet its obligation to pay the costs, the Owner may elect not to accept bonds submitted in the future by the Surety. Finding the Contractor in default shall constitute a reason for disqualification of the Contractor from bidding on future state contracts.

12.2.2 After Substantial Completion

12.2.2.1 At the end of the paragraph delete the last sentence and add the following sentences:

“If the Contractor fails to correct nonconforming Work, or Work covered by warranties, within a thirty (30) day period, through no fault of the Architect or Owner, the Owner may hold the Contractor in default. If the Owner finds the Contractor is in default, the Surety shall be notified. If within thirty (30) days after notification, the Surety has not corrected the non-conforming or warranty Work, through no fault of the Architect or Owner, the Owner may contract to have the nonconforming or warranty Work corrected and hold the Surety responsible for the cost including architects fees and other indirect costs. Corrections by the Owner shall be in accordance with Section 2.4. If the Surety fails to correct the nonconforming or warranty Work within the stipulated time period and fails to meet its obligation to pay the costs, the Owner may not accept bonds submitted, in the future, by the Surety.”

ARTICLE 13

MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

Delete all after the word “located”.

13.2 SUCCESSORS AND ASSIGNS

13.2.1 In the second sentence, delete “Except as ... 13.2.2”

Delete Section 13.2.2.

13.3 RIGHTS AND REMEDIES

Add the following Section 13.3.3:

13.3.3 The Nineteenth Judicial Court in and for the Parish of East Baton Rouge, State of Louisiana shall have sole jurisdiction and venue in any action brought under this contract.

13.4 TESTS AND INSPECTIONS

In Section 13.4.1, delete the second sentence and substitute the following:

The Contractor shall make arrangements for such tests, inspections and approvals with the Testing Laboratory provided by the Owner, and the Owner shall bear all related costs of tests, inspections and approvals.

Delete the last two sentences of Section 13.4.1.

13.5 INTEREST

Delete Section 13.5.

ARTICLE 14**TERMINATION OR SUSPENSION OF THE CONTRACT****14.1 TERMINATION BY THE CONTRACTOR**

Delete Section 14.1.1.4.

In Section 14.1.3, after the word “profit,” delete the words “on Work not executed” and substitute the following: “for Work completed prior to stoppage”.

14.2 TERMINATION BY THE OWNER FOR CAUSE

Add the following Section:

14.2.1.5 failure to complete the punch list within the lien period as provided in 9.8.7.

14.2.3 Add the following sentence:

“Termination by the Owner shall not suspend assessment of liquidated damages against the Surety.”

Add the following Section:

14.2.5 If an agreed sum of liquidated damages has been established, termination by the Owner under this Article shall not relieve the Contractor and/or Surety of his obligations under the liquidated damages provisions and the Contractor and/or Surety shall be liable to the Owner for per diem liquidated damages.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

In Section 14.4.3, delete all after “incurred by reason of the termination,” and add “along with reasonable profit on the Work not executed.”

ARTICLE 15

CLAIMS AND DISPUTES

15.1 CLAIMS

Delete Section 15.1.2, **Time Limit on Claims**, (See La R.S. 38:2189, and 38:2189.1).

15.1.3.1 Add the following to the end of the paragraph:

“A Reservation of Rights and similar stipulations shall not be recognized under this contract as having any effect. A party must make a claim as defined herein within the time limits provided.”

15.1.4.2 In the first sentence of the Section, delete “Initial Decision Maker’s” and replace with “Architect’s”. In the second sentence of the Section, delete “the decision of the Initial Decision Maker” and replace with: “his/her decision”.

Delete Section 15.1.6.2 and substitute the following:

15.1.6.2 If adverse weather conditions are the basis for a claim for additional time, the Contractor shall document that weather conditions had an adverse effect on the scheduled construction. An increase in the contract time due to weather shall not be cause for an increase in the contract sum. At the end of each month, the Contractor shall make one Claim for any adverse weather days occurring within the month. The Claim must be accompanied by sufficient documentation evidencing the adverse days and the impact on construction. Failure to make such Claim within **twenty-one (21) days** from the last day of the month shall prohibit any future claims for adverse days for that month. No additional adverse weather days shall be granted after the original or extended contract completion date, except those adverse weather days associated with a National Weather Service named storm or federally declared weather related disaster directly affecting the project site.

Add the following Section:

- 15.1.6.3 The following are considered reasonably anticipated days of adverse weather on a monthly basis:

January	<u>11</u> days	July	<u>6</u> days
February	<u>10</u> days	August	<u>5</u> days
March	<u>8</u> days	September	<u>4</u> days
April	<u>7</u> days	October	<u>3</u> days
May	<u>5</u> days	November	<u>5</u> days
June	<u>6</u> days	December	<u>8</u> days

The Contractor shall ask for total adverse weather days. The Contractor's request shall be considered only for days over the allowable number of days stated above.

Note: Contract is on a calendar day basis.

15.2 INITIAL DECISION

- 15.2.1 In the second sentence, delete the word "will" and replace with: "shall always".

In the second sentence, delete the phrase: " , unless otherwise indicated in the Agreement."

In the third sentence, delete the word "mediation" and replace with: "litigation".

At the end of the third sentence, add: "arising prior to the date final payment is due".

Delete the fourth sentence.

- 15.2.5 In the middle of the first sentence, delete all after the phrase: "rejecting the Claim".

In the second sentence, delete the phrase: "and the Architect, if the Architect is not serving as the Initial Decision Maker,".

In the third sentence, delete all after: "binding on the parties" and add the following: "except that the Owner may reject the decision or suggest a compromise or both".

Delete Section 15.2.6.

Delete Section 15.2.6.1.

15.3 MEDIATION

Delete Section 15.3.

15.4 ARBITRATION

Delete Section 15.4.

This document will be prepared by Facility Planning & Control in the form appropriate for the project.

CONTRACT BETWEEN OWNER AND CONTRACTOR
AND PERFORMANCE AND PAYMENT BOND

C 1

indemnify and save harmless the Owner, from all cost and damages which he may suffer by said Contractor's non-performance or should said Contractor not pay all persons who have and fulfill obligations to perform labor and/or furnish materials in the prosecution of the work provided for herein, including by way of example workmen, laborers, mechanics, and furnishers of materials, machinery, equipment and fixtures, then said Surety agrees and is bound to so perform the contract and make said payment(s).

Provided, that any alterations which may be made in the terms of the contract or in the work to be done under it, or the giving by the Owner of any extensions of time for the performance of the contract, or any other forbearance on the part of either the Owner or the Contractor to the other shall not in any way release the Contractor or the Surety from their liability hereunder, notice to the Surety of any such alterations, extensions or other forbearance being hereby waived.

Contractor acknowledges and agrees to comply with the provisions of La. R.S. 38:2212.10 and federal law pertaining to E-Verify in the performance of services under this Contract.

It is hereby agreed that the Legislative Auditor of the State of Louisiana and/or the Office of the Governor, Division of Administration auditors shall have the option of auditing all accounts of contractor which relate to this contract.

The continuation of this contract is contingent upon the appropriation of funds to fulfill the requirements of the contract by the legislature. If the legislature fails to appropriate sufficient monies to provide for the continuation of the contract, or if such appropriation is reduced by the veto of the Governor or by any means provided in the appropriations act to prevent the total appropriation for the year from exceeding revenues for that year, or for any other lawful purpose, and the effect of such reduction is to provide insufficient monies for the continuation of the contract, the contract shall terminate on the date of the beginning of the first fiscal year for which funds are not appropriated.

The contractor agrees to abide by the requirements of the following as applicable: Title VI of the Civil Rights Act of 1964 and Title VII of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972, Federal Executive Order 11246 as amended, the Rehabilitation Act of 1973, as amended, the Vietnam Era Veteran's Readjustment Assistance Act of 1974, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, the Fair Housing Act of 1968 as amended, and contractor agrees to abide by the requirements of the Americans with Disabilities Act of 1990.

Contractor agrees not to discriminate in its employment practices, and will render services under this contract without regard to race, color, religion, sex, sexual orientation, national origin, veteran status, political affiliation, disability, or age in any matter relating to employment. Any act of discrimination committed by Contractor, or failure to comply with these statutory obligations when applicable shall be grounds for termination of this contract.

In accordance with R.S. 39:1602.1, effective May 22, 2018, for any contract for \$100,000 or more and for any contractor with five or more employees, Contractor, or any Subcontractor, shall certify it is not engaging in a boycott of Israel, and shall, for the duration of this contract, refrain from a boycott of Israel. The State reserves the right to terminate this contract if the Contractor, or any Subcontractor, engages in a boycott of Israel during the term of the contract.

In accordance with La. R.S. 39:1602.2, the following applies to any competitive sealed bids, competitive sealed proposals, or contract(s) with a value of \$100,000 or more involving a for-profit company with at least fifty full-time employees:

Unless otherwise exempted by law, by submitting a response to this solicitation or entering into this contract, the Bidder, Proposer or Contractor certifies the following:

1. The company does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association based solely on the entity's or association's status as a firearm entity or firearm trade association;
2. The company will not discriminate against a firearm entity or firearm trade association during the term of the contract based solely on the entity's or association's status as a firearm entity or firearm trade association.

The State reserves the right to reject the response of the Bidder, Proposer or Contractor if this certification is subsequently determined to be false, and to terminate any contract awarded based on such a false response or if the certification is no longer true.

Contractor has a continuing obligation to disclose any suspensions or debarment by any government entity, including but not limited to General Services Administration (GSA). Failure to disclosed may constitute grounds for suspension and/or termination of the Contract and debarment from future Contracts.

Contractor, and each tier of Subcontractors, shall certify that it is not on the List of Parties Excluded from Federal Procurement or Nonprocurement Programs promulgated in accordance with E.O.s 12549 and 12689, "Debarment and Suspension," as set forth at 24 CFR part 24.

In Witness whereof, the parties hereto on the day and year first above written have executed this agreement in six (6) counterparts, each of which shall, without proof or accountancy for the other counterparts, be deemed an original thereof.

THUS DONE AND SIGNED at Baton Rouge, Louisiana, on the day, month, and year first written above.

WITNESSES:

STATE OF LOUISIANA
DIVISION OF ADMINISTRATION

FP&C Witness #1 Sign Here

BY: _____
MATTHEW H. BAKER,
FP&C DIRECTOR

FP&C Witness #2 Sign Here

Contractor Witness #1 Sign Here

BY: _____
«CONTRACTOR»

Contractor Witness #2 Sign Here

SURETY:

Surety Witness #1 Sign Here

BY: _____
ATTORNEY IN FACT

Surety Witness #2 Sign Here

ADDRESS

TELEPHONE NUMBER

PROJECT NO.:	«ProjectNo», «Part_No»«WBS»: «Supplement Project_No», Part «Supplement_Part_No» («Supplement_WBS»)(Supplement)
NAME:	«Project_Reference_1» «Project_Reference_2» «Project_Reference_3»
LOCATION:	«Project_City»

NON-COLLUSION AFFIDAVIT

Before me, the undersigned authority, duly commissioned and qualified within and for the State and Parish aforesaid, personally came and appeared _____ representing **«Contractor»** who, being by me first duly sworn deposed and said that he has read this affidavit and does hereby agree under oath to comply with all provisions herein as follows:

PART I.

Section 2224 of Part II of Chapter 10 of Title 38 of the Louisiana Revised Statutes, as amended.

(1) That affiant employed no person, corporation, firm, association, or other organization, either directly or indirectly, to secure the public contract under which he received payment, other than persons regularly employed by the affiant whose services in connection with the construction, alteration or demolition of the public building or project or in securing the public contract were in the regular course of their duties for affiant; and

(2) That no part of the Contract price received by affiant was paid or will be paid to any person, corporation, firm, association, or other organization for soliciting the Contract, other than the payment of their normal compensation to persons regularly employed by the affiant whose services in connection with the construction, alteration or demolition of the public building or project were in the regular course of their duties for affiant.

PART II.

Section 2190 of Part I of Chapter 10 of Title 38 of the Louisiana Revised Statutes, as amended.

That affiant, if an architect or engineer, or representative thereof, does not own a substantial financial interest, either directly or indirectly, in any corporation, firm, partnership, or other organization which supplies materials for the construction of a public work when the architect or engineer has performed architectural or engineering services, either directly or indirectly, in connection with the public work for which the materials are being supplied.

For the purposes of this Section, a "substantial financial interest" shall exclude any interest in stock being traded on the American Stock Exchange or the New York Stock Exchange.

That affiant, if subject to the provisions of this section, does hereby agree to be subject to the penalties involved for the violation of this section.

AFFILIANT

SWORN TO AND SUBSCRIBED BEFORE ME THIS DAY OF , 2025.

NOTARY

Name of Project
School of Construction Practice Lab Building
Universite of Louisiana at Monroe
507 Filhiol Ave. Monroe, Louisiana 71203

Project No.
19-629-23-01, F.19002614
Site Code 8-37-007 ID S08890

STATE OF Louisiana
PARISH OF Ouachita

ATTESTATIONS AFFIDAVIT

Before me, the undersigned notary public, duly commissioned and qualified in and for the parish and state aforesaid, personally came and appeared Affiant, who after being duly sworn, attested as follows:

LA. R.S. 38:2227 PAST CRIMINAL CONVICTIONS OF BIDDERS

A. No sole proprietor or individual partner, incorporator, director, manager, officer, organizer, or member who has a minimum of a ten percent (10%) ownership in the bidding entity named below has been convicted of, or has entered a plea of guilty or nolo contendere to any of the following state crimes or equivalent federal crimes:

- | | |
|---------------------------------------|------------------------------------|
| (a) Public bribery (R.S. 14:118) | (c) Extortion (R.S. 14:66) |
| (b) Corrupt influencing (R.S. 14:120) | (d) Money laundering (R.S. 14:230) |

B. Within the past five years from the project bid date, no sole proprietor or individual partner, incorporator, director, manager, officer, organizer, or member who has a minimum of a ten percent (10%) ownership in the bidding entity named below has been convicted of, or has entered a plea of guilty or nolo contendere to any of the following state crimes or equivalent federal crimes, during the solicitation or execution of a contract or bid awarded pursuant to the provisions of Chapter 10 of Title 38 of the Louisiana Revised Statutes:

- | | |
|--|--|
| (a) Theft (R.S. 14:67) | (f) Bank fraud (R.S. 14:71.1) |
| (b) Identity Theft (R.S. 14:67.16) | (g) Forgery (R.S. 14:72) |
| (c) Theft of a business record
(R.S.14:67.20) | (h) Contractors; misapplication of
payments (R.S. 14:202) |
| (d) False accounting (R.S. 14:70) | (i) Malfeasance in office (R.S. 14:134) |
| (e) Issuing worthless checks
(R.S. 14:71) | |

LA. R.S. 38:2212.10 Verification of Employees

- A. At the time of bidding, Appearer is registered and participates in a status verification system to verify that all new hires in the state of Louisiana are legal citizens of the United States or are legal aliens.
- B. If awarded the contract, Appearer shall continue, during the term of the contract, to utilize a status verification system to verify the legal status of all new employees in the state of Louisiana.
- C. If awarded the contract, Appearer shall require all subcontractors to submit to it a sworn affidavit verifying compliance with Paragraphs (A) and (B) of this Subsection.

Name of Project
School of Construction Practice Lab Building
Universite of Louisiana at Monroe
507 Filhiol Ave. Monroe, Louisiana 71203

Project No.
19-629-23-01, F.19002614
Site Code 8-37-007 ID S08890

STATE OF Louisiana
PARISH OF Ouachita

LA. R.S. 23:1726(B) Certification Regarding Unpaid Workers Compensation Insurance

- A. R.S. 23:1726 prohibits any entity against whom an assessment under Part X of Chapter 11 of Title 23 of the Louisiana Revised Statutes of 1950 (Alternative Collection Procedures & Assessments) is in effect, and whose right to appeal that assessment is exhausted, from submitting a bid or proposal for or obtaining any contract pursuant to Chapter 10 of Title 38 of the Louisiana Revised Statutes of 1950 and Chapters 16 and 17 of Title 39 of the Louisiana Revised Statutes of 1950.
- B. By signing this bid /proposal, Affiant certifies that no such assessment is in effect against the bidding / proposing entity.

NAME OF BIDDER

NAME OF AUTHORIZED SIGNATORY OF BIDDER

DATE

TITLE OF AUTHORIZED SIGNATORY OF BIDDER

**SIGNATURE OF AUTHORIZED
SIGNATORY OF BIDDER/AFFIANT**

Sworn to and subscribed before me by Affiant on the ____ day of _____, 20__.

Notary Public

SCHEDULE OF VALUES

The Contractor is to use the following format. The total Contract Cost is to be itemized in each Subsection listed (as applicable)

DIVISION 01 – GENERAL REQUIREMENTS	Quantity	Cost
01 00 00 General Requirements	_____	_____
01 32 50 Record Drawings, Shop Drawings, Product Data, Samples and other submittals.	_____	_____
	TOTAL	_____
DIVISION 02 – EXISTING CONDITIONS		
02 30 00 Subsurface Investigation	_____	_____
02 41 00 Demolition	_____	_____
	TOTAL	_____
DIVISION 03 – CONCRETE		
03 01 00 Maintenance of Concrete	_____	_____
03 11 00 Concrete Forming	_____	_____
03 15 00 Concrete Accessories	_____	_____
03 20 00 Concrete Reinforcing	_____	_____
03 30 00 Cast-in-place Concrete	_____	_____
03 40 00 Precast Concrete	_____	_____
03 50 00 Cast Decks & Underlayment	TOTAL	_____
DIVISION 04 – MASONRY		
04 01 00 Maintenance of Masonry	_____	_____
04 05 13 Masonry Mortaring	_____	_____
04 05 19 Masonry Anchorage & Reinforcing	_____	_____
04 05 23 Masonry Accessories	_____	_____
04 20 00 Unit Masonry	TOTAL	_____
DIVISION 05 – METALS		
05 05 23 Metal Fastenings	_____	_____
05 10 00 Structural Metal Framing	_____	_____
05 20 00 Metal Joists	_____	_____
05 30 00 Metal Decking	_____	_____
05 50 00 Metal Fabrications	_____	_____
05 58 00 Formed Metal Fabrications	TOTAL	_____
DIVISION 06 – WOOD, PLASTICS, & COMPOSITES		
06 05 23 Fastening and Adhesives	_____	_____
06 10 00 Rough Carpentry	_____	_____
06 13 00 Heavy Timber	_____	_____
06 17 00 Shop-fabricated Structural Wood	_____	_____
06 20 00 Finish Carpentry	SUB-TOTAL	_____

DISISION 06 – WOOD, PLASTICS, &
COMPOSITES (CONTINUES)

06 40 00	Architectural Woodwork	_____	_____
06 60 00	Plastic Fabrications	_____	_____
06 80 00	Composite Fabrications	_____	_____
		TOTAL	_____

DIVISION 07 – THERMAL AND MOISTURE
PROTECTION

07 10 00	Dampproofing and Waterproofing	_____	_____
07 18 00	Traffic Coatings	_____	_____
07 19 00	Water Repellents	_____	_____
07 21 00	Thermal Insulation	_____	_____
07 24 00	Exterior Insulation & Finish Systems	_____	_____
07 25 00	Weather Barriers	_____	_____
07 31 00	Shingles and Shakes	_____	_____
07 32 00	Roof Tiles	_____	_____
07 40 00	Roofing and Siding Panels	_____	_____
07 50 00	Membrane Roofing	_____	_____
07 60 00	Flashing and Sheet Metal	_____	_____
07 61 00	Sheet Metal Roofing	_____	_____
07 70 00	Roof & Wall Specialties and Accessories	_____	_____
07 80 00	Fire and Smoke Protection	_____	_____
07 90 00	Joint Protection	_____	_____
07 95 00	Expansion Control	_____	_____
		TOTAL	_____

DIVISION 08 – OPENINGS

08 11 00	Metal Doors and Frames	_____	_____
08 14 00	Wood Doors	_____	_____
08 15 00	Plastic Doors	_____	_____
08 30 00	Specialty Doors and Frames	_____	_____
08 41 00	Entrances and Storefronts	_____	_____
08 44 00	Curtain Wall and Glazed Assemblies	_____	_____
08 51 00	Metal Windows	_____	_____
08 52 00	Wood Windows	_____	_____
08 53 00	Plastic Windows	_____	_____
08 56 00	Special Function Windows	_____	_____
08 60 00	Roof Windows and Skylights	_____	_____
08 70 00	Hardware	_____	_____
08 80 00	Glazing	_____	_____
08 90 00	Louvers and Vents	_____	_____
		TOTAL	_____

DIVISION 09 – FINISHES

09 22 00	Supports for Plaster and Gypsum Board	_____	_____
09 23 00	Gypsum Plastering	_____	_____
09 24 00	Portland Cement Plastering	_____	_____
09 29 00	Gypsum Board	_____	_____
09 30 00	Tiling	_____	_____
		SUB-TOTAL	_____

DIVISION 09 – FINISHES (CONTINUED)

09 50 00	Acoustical Ceilings	_____	_____
09 54 00	Specialty Ceilings	_____	_____
	Quantity	_____	_____
09 61 00	Flooring Treatment	_____	_____
09 62 00	Specialty Flooring	_____	_____
09 63 00	Masonry Flooring	_____	_____
09 64 00	Wood Flooring	_____	_____
09 65 00	Resilient Flooring	_____	_____
09 66 00	Terrazzo Flooring	_____	_____
09 68 00	Carpeting	_____	_____
09 69 00	Access Flooring	_____	_____
09 97 00	Wall Finishes	_____	_____
09 91 00	Painting	_____	_____
09 97 00	Special Coatings	_____	_____
	TOTAL	_____	_____

DIVISION 10 – SPECIALTIES

10 11 00	Visual Display Surfaces	_____	_____
10 14 00	Signage	_____	_____
10 21 00	Compartments and Cubicles	_____	_____
10 22 00	Partitions	_____	_____
10 26 00	Wall and Door Protection	_____	_____
10 28 00	Toilet, Bath, and Laundry Accessories	_____	_____
10 44 00	Fire Protection Specialties	_____	_____
10 51 00	Lockers	_____	_____
10 56 00	Storage Assemblies	_____	_____
10 82 00	Grilles and Screens	_____	_____
	TOTAL	_____	_____

DIVISION 11 – EQUIPMENT

11 15 00	Security, Detention, and Banking Equipment	_____	_____
11 19 00	Detention Equipment	_____	_____
11 23 00	Commercial Laundry and Dry Cleaning Equipment	_____	_____
11 26 00	Unit Kitchens	_____	_____
11 27 00	Photographic Processing Equipment	_____	_____
11 40 00	Foodservice Equipment	_____	_____
11 51 00	Library Equipment	_____	_____
11 52 00	Audio-Visual Equipment	_____	_____
11 53 00	Laboratory Equipment	_____	_____
11 61 00	Theater and Stage Equipment	_____	_____
11 65 00	Athletic and Recreational Equipment	_____	_____
11 70 00	Healthcare Equipment	_____	_____
	TOTAL	_____	_____

DIVISION 12 – FURNISHINGS

12 20 00	Window Treatments	_____	_____
12 30 00	Casework	_____	_____
12 40 00	Furnishings and Accessories	_____	_____
12 50 00	Furniture	_____	_____
	TOTAL	_____	_____

DIVISION 13 – SPECIAL CONSTRUCTION

13 10 00	Special Facility Components	_____	_____
13 34 00	Fabricated Engineered Structures	_____	_____
13 49 00	Radiation Protection	_____	_____
	TOTAL	_____	_____

DIVISION 14 – CONVEYING EQUIPMENT

14 20 00	Elevators	_____	_____
14 30 00	Escalators and Moving Walks	_____	_____
14 40 00	Lifts	_____	_____
14 80 00	Scaffolding	_____	_____
	TOTAL	_____	_____

DIVISION 21 – FIRE SUPPRESSION

21 10 00	Water-Based Fire-Suppression Systems		
	Piping	_____	_____
21 20 00	Fire-Extinguishing Systems	_____	_____
21 30 00	Fire Pumps	_____	_____
	TOTAL	_____	_____

DIVISION 22 – PLUMBING

22 07 00	Plumbing Insulation	_____	_____
22 11 00	Facility Water Distribution	_____	_____
22 13 00	Facility Sanitary Sewerage	_____	_____
22 14 00	Facility Storm Drainage	_____	_____
22 30 00	Plumbing Equipment	_____	_____
22 40 00	Plumbing Fixtures	_____	_____
	TOTAL	_____	_____

DIVISION 23 – HEATING, VENTILATING, & AIR-CONDITIONING

23 05 93	Testing, Adjusting, & Balancing for HVAC	_____	_____
23 07 00	HVAC Insulation	_____	_____
23 09 00	Instrumentation & Control for HVAC	_____	_____
23 13 00	Facility Fuel-Storage Tanks	_____	_____
23 20 00	HVAC Piping and Pumps	_____	_____
23 30 00	HVAC Air Distribution	_____	_____
23 40 00	HVAC Air Cleaning Devices	_____	_____
23 50 00	Central Heating Equipment	_____	_____
23 60 00	Central Cooling Equipment	_____	_____
23 70 00	Central HVAC Equipment	_____	_____
	TOTAL	_____	_____

DIVISION 26 – ELECTRICAL

26 09 00	Instrumentation & Control for Electrical Systems	_____	_____
26 10 00	Medium-Voltage Electrical Distribution	_____	_____
26 20 00	Low-Voltage Electrical Transmission	_____	_____
26 27 00	Low-Voltage Distribution Equipment	_____	_____
26 30 00	Facility Electrical Power Generating & Storage Equipment	_____	_____
26 40 00	Electrical and Cathodic Protection	_____	_____
26 50 00	Lighting	_____	_____
	TOTAL	_____	_____

DIVISION 27 – COMMUNICATIONS

27 10 00	Structured Cabling	_____	_____
27 20 00	Data Communications	_____	_____
27 30 00	Voice Communications	_____	_____
27 40 00	Audio-Video Communications	_____	_____
27 50 00	Distributed Communications & Monitoring Systems	_____	_____
		TOTAL	_____

DIVISION 28 – ELECTRONIC SAFETY AND
SECURITY

28 10 00	Electronic Access Control & Intrusion Detection	_____	_____
28 20 00	Electronic Surveillance	_____	_____
28 30 00	Electronic Detection and Alarm	_____	_____
28 40 00	Electronic Monitoring and Control	_____	_____
		TOTAL	_____

DIVISION 31 – EARTHWORK

31 10 00	Site Clearing	_____	_____
31 20 00	Earth Moving	_____	_____
31 31 00	Soil Treatment	_____	_____
31 32 00	Soil Stabilization	_____	_____
31 40 00	Shoring and Underpinning	_____	_____
31 50 00	Excavation Support and Protection	_____	_____
31 60 00	Special Foundations and Load- Bearing Elements	_____	_____
		TOTAL	_____

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 10 00	Bases, Ballasts, and Paving	_____	_____
32 30 00	Site Improvements	_____	_____
32 90 00	Planting	_____	_____
		TOTAL	_____

DIVISION 33 – UTILITIES

33 10 00	Water Utilities	_____	_____
33 30 00	Sanitary Sewerage Utilities	_____	_____
33 40 00	Storm Drainage Utilities	_____	_____
33 50 00	Fuel Distribution Utilities	_____	_____
33 60 00	Hydronic & Steam Energy Utilities	_____	_____
33 70 00	Electrical Utilities	_____	_____
33 80 00	Communications Utilities	_____	_____
		TOTAL	_____

DIVISION 34 – TRANSPORTATION

34 00 00	Transportation	_____	_____
		TOTAL	_____

DIVISION 35 – WATERWAY AND MARINE
CONSTRUCTIONS

35 00 00	Waterway and Marine construction	_____	_____
		TOTAL	_____

DIVISION 40-43 – PROCESS EQUIPMENT

DIVISION 44 – POLLUTION CONTROL
EQUIPMENT

44 40 00	Water Treatment Equipment	_____	_____
44 41 00	Packaged Water Treatment Plants	_____	_____
44 50 00	Solid Waste Control	_____	_____
		TOTAL	_____

DIVISION 45 – INDUSTRY SPECIFIC
MANUFACTURING
EQUIPMENT

DIVISION 48 – ELECTRICAL POWER
GENERATION

48 10 00	Electrical Power Generation Equipment	_____	_____
48 70 00	Electrical Power Generation Testing	_____	_____
		TOTAL	_____

❖ NOT FOR RECORDATION PURPOSES ❖

Facility Planning & Control
RECOMMENDATION OF ACCEPTANCE

TO: FACILITY PLANNING AND CONTROL
P.O. Box 94095
Baton Rouge, LA 70804-9095

FROM: TBA Holdings, Inc./dba/TBA Studio
103 Cypress Street
West Monroe, LA. 71291

DATE: _____

PROJECT NAME: _____

PROJECT NUMBER: _____ WBS No. _____

SITE CODE: _____ STATE ID: _____ CFMS/SRM #: _____

CONTRACTOR: _____

ORIGINAL CONTRACT AMOUNT: \$ _____

FINAL CONTRACT AMOUNT: \$ _____

FINAL BUILDING AREA (SQ. FEET): _____

I certify that, to the best of my knowledge and belief, this project is substantially complete in accordance with the Plans and Specifications to the point where it can be used for the purpose which was intended. It is recommended that it be accepted.

DATE OF ACCEPTANCE: _____

CONTRACT DATE OF COMPLETION: _____

NUMBER OF DAYS (OVERRUN) (UNDERRUN) (As of Acceptance Date) _____

LIQUIDATED DAMAGES PER DAY STIPULATED IN CONTRACT \$ _____

VALUE OF PUNCH LIST \$ _____ (Attach punch list)

Was part of project occupied prior to Acceptance?

PORTION OCCUPIED: (Attach Partial Occupancy Forms)

ROOF GUAR-MANUF: _____ START DATE: _____ END DATE: _____

ROOFER: _____ START DATE: _____ END DATE: _____

Signed: _____
DESIGNER

FOR USE OF PROJECT MANAGER:

Signed: _____
PROJECT MANAGER

c: User Agency

❖ NOT FOR RECORDATION PURPOSES ❖

CERTIFICATE OF COMPLIANCE
with
Americans with Disabilities Act and Architectural Barriers Act
Accessibility Guidelines

TO: FACILITY PLANNING AND CONTROL
P.O. Box 94095
Baton Rouge, LA 70804-9095

FROM:

Design Firm Name and Address

PROJECT NAME:

PROJECT No.:

WBS No.:

SITE CODE: _____ STATE ID: _____

DATE OF ACCEPTANCE: _____

I, _____ certify that, to the best of my knowledge and belief, this project has been constructed in compliance with the Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines as reviewed by the fire marshal.

Designer Signature Date: _____

State of Louisiana
DIVISION OF ADMINISTRATION
Facility Planning and Control

CERTIFICATE OF COMPLIANCE
with
Louisiana Building Code for State Owned Buildings

TO: STATE OF LOUISIANA
DIVISION OF ADMINISTRATION
OFFICE OF FACILITY PLANNING AND CONTROL
P.O. Box 94095
Baton Rouge, LA 70804-9095

FROM:

(Design Firm or Owner/User Name and Address)

PROJECT NAME:

PROJECT No.:

WBS No.:

DATE OF ACCEPTANCE: _____

I, _____ certify that, to the best of my knowledge and belief, this project has been constructed in compliance with the construction documents determined to be satisfactory by the State of Louisiana, Division of Administration, Office of Facility Planning and Control.

(Signature of Designer or Owner/User) Date: _____

❖ NOT FOR RECORDATION PURPOSES ❖

Facility Planning & Control PARTIAL OCCUPANCY

PROJECT NAME: School of Construction Practice Lab Building University of Louisiana at Monroe

PROJECT LOCATION: University of Louisiana at Monroe 507 Filhiol Ave. Monroe, Louisiana 71203

PROJECT / PART NUMBER: 19-629-23-0, F.19002614

CFMS / SRM No.

WBS NUMBER:

CONTRACTOR:

USER AGENCY:

The below described portion of subject project is, to the best of my knowledge and belief, complete to a point where the User desires to use in according with the Contract Documents.

DATE OCCUPIED: _____ .

WARRANTY items covered by Occupancy:

_____ Designer	_____ Date
_____ Contractor	_____ Date
_____ Facility Planning and Control	_____ Date

Punch List: Attached ☐

None ☐

c: User Agency

❖ NOT FOR RECORDATION PURPOSES ❖

December 2023

Project No. 19-629-23-01,F.19002614

PO-1

Facility Planning & Control
4. RECOMMENDED AGENDA FOR ROOFING CONFERENCES

Project Name: School of Construction Practice Lab Building University of Louisiana at Monroe

Project Number & WBS: 19-269-23-01, F.19002614

Conference Location: _____ Date: _____

Type of Conference: _____ Preliminary _____ Pre-Application _____ Final Inspection

Designer: _____

Roofing Contractor: _____

General Contractor: _____

CONFERENCES ATTENDEES:

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
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_____	_____	_____	_____
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_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

AGENDA FOR PRELIMINARY ROOFING CONFERENCE

PURPOSE: Establish a direct line of communication, iron out initial questions regarding the project and to review project submittal requirements.

TIMING: The meeting should be held shortly after award of the Contract and at least six weeks prior to the anticipated start of roofing. Re-Roofing Projects may combine with Pre-Const. Conf. (ITB § 15).

1. A complete set of Contract Documents (plans and specifications) to be available for review.
2. All meeting minutes to be furnished by the Designer to all parties within 7 days. Establish project record keeping procedures.
3. Review tentative progress schedule for roofing. Set approximate date.
4. Review roofing system and insulation requirements. Size (4'x4' adhered, 4'x8' Mech. Fastened) and Thickness (R-Value), Staggered Joints
5. Weather considerations as they may apply to the project roofing installation.
6. Temporary roofing guidelines for the project. Who and when, will final decision be made, if necessary.
7. Inspection and Testing Requirements:

Name of Inspection Firm:

Name of inspector:

Phone:

- _____
a. On-Site Inspection - Discuss project requirements.
b. Laboratory Tests

8. Roof Deck:

Type and Thickness: (if Lt. Wt. Conc. has a Pull Test been done?)

Slope: ____ Location and Type of Drains:

Tentative Schedule for Installation:

Nailers, curbs, and sheet metal must be completed prior to roofing application. Review CD Details, and discuss if raising Equip. Curbs is required or not.

9. Discuss material storage areas, dumpster location, worker parking, and equipment set-up locations. Review requirements.

10. Specific submittals from the Roofing Contractor:

- a. Material approval list
- b. Shop drawings (if any)
- c. Product material brochures and samples
- d. Manufacturer's Guarantee review for compliance with specifications (20-Year State Warranty)
- e. Manuf. Assembly Letter (required for Pre-App. Conf. as well as materials on site)

11. Specific project detail discussion. (Include perimeter wall construction and rooftop mechanical equipment details, necessity of disconnecting any Exist. Rooftop Equip.)

12. Other:

13. Review above items briefly and establish date for tentative Pre-Application Conference. (Manuf. Assembly Letter and materials therein required on site prior to scheduling conference). Roof Manuf. Rep. and FP&C Roof Consultant to be scheduled to attend.

AGENDA FOR ROOFING PRE-APPLICATION CONFERENCE

PURPOSE:

- To verify readiness of the project structure
- To walk site with Roof Manuf. Assembly Letter in hand, verifying materials on site comply.
- To scan last minute details, changes or corrections
- To review anticipated schedule of progress

TIMING: Following receipt of Roof Manuf. Assembly Letter, all materials on letter delivered to site, and prior to Roofing Work.

ATTENDANCE: List attendees
(Required attendees: FP&C Project Manager, FP&C Roofing Consultant, Roof Manuf. Rep., User Agency Contact, Designer, Contractor Superintendent.)

1. Copies of approved submittals should be available for review. Are any material changes required due to availability problems or other? Reminder that formal approvals are still required.
2. Review minutes of Preliminary Conference.
3. Discuss revised Roofing Application Schedule.
4. Check equipment set-up and on-site material storage.
5. Deck Readiness:
 - a. Any required roof deck certifications must be in order
 - b. Rooftop inspection by those in attendance
 - c. Drain hookups complete
 - d. Curbs, nailers, roof deck penetrations, perimeter edges and mechanical equipment - should all be set and complete. Roof Drain Pipes are verified free of Demo Debris

6. Review roof system, including insulation above deck. Discuss the required application of each to the other components.

- a. (2) Layers Polyiso Insulation (staggered), (1) Layer Cover Board (any special techniques required?)
- b. Mechanical or adhesive attachments (Mech. Fasteners = 4'x8' or Adhesion = 4'x4' board size)
- c. Vapor Retarders
- d. Flashings
- e. Saddles and/or crickets
- f. Venting
- g. Sheet metal

7. Phase Construction Guidelines for project. Factors affecting guidelines include local practices, climate and weather considerations. Tie-offs at days end.

8. Temporary roofing final decisions.

9. Housekeeping, material handling and finished work protection requirements.

10. Inspection and testing requirements - State Roofing Consultant at Final Inspection; Roof Manuf. Inspector as required and at Final Inspection.

11. Project changes in plans, specifications or procedures to be followed - discuss and establish who can approve and how documented.

12. Contractor must provide State 2-Yr Guarantee, and perform 1 & 2 Year Inspections. Roof Manuf. must provide 20-Yr Warranty. Pre-Finished Metal Manuf. must provide 20-Year Finish Warranty.

NOTES

AGENDA FOR ROOFING FINAL INSPECTION

PURPOSE: To assure 100% completion of contract requirements.

TIMING: Prior to the Roofing Contractor concludes his work at the site.

1. Attendance must include those in attendance at the Pre-Application Conference.
2. Complete rooftop walk over and review:
 - a. Perimeter edges
 - b. Walls
 - c. Curbs and other equipment
 - d. Drains
 - e. Rooftop penetrations
 - f. Site cleanup
 - g. Sheet metal
 - h. Any special conditions
3. Final Punch List establishment of items to be completed. Copies to all parties. Attached to Meeting Minutes issued by Designer
4. Summary of project records. Organize for final file. Wrap up any loose ends.
5. Stress importance of Bi-Annual (and after storm) Maintenance to User-Agency (keep file for claim)
6. Discuss responsibility for roof system protection until project completed. Responsibility for coordination usually rests with General Contractor. Any damage or additional work to be conducted by original Roofing Contractor in order to keep original guarantee valid.
7. Acceptance by the state will not be issued without submittal and approval of fully executed

NOTES

guarantees for each type of roof installed, which shall include, but not necessarily be limited to the following applicable forms, which can be found on the Instructions to Designers page of the FPC Website:

- a. Recommendation of Acceptance (ROA): (Designer's Responsibility)
- b. Letter of Concurrence: Concurring in Designer's ROA (User Agency's Responsibility)
- c. Roof Completion Information Form: with a Roof Plan on 8-1/2"x11" of Individual State ID's or different Material Roof (Designer's Responsibility)
- d. Roof Guarantee/Warranty (2): (Contractor's Responsibility)
 - i. 20-Year Manuf. Membrane Warranty (State Form in ITD § 28e; 28d for Metal Roof)
 - ii. 2-Year Contractor Warranty R-1 (Sub & GC) or R-2 (GC) (State Forms in ITD § 28a, 28b); 28c for Metal Roof)
- e. Final Cost & Const. Data Report: Div. 7 Primarily, attached to "DESIGNER LETTER" E-mail when project began (Designer's Responsibility)
- f. As-Builts: Const. that changed from Contract Docs, Marked-up Job Prints delivered to designer (Contractor's Responsibility)
- g. Final Documents delivered: drawings & specs marked "RECORD DOCUMENTS" as Hard-copy, as well as PDF & CAAD DWG Files (include Line Weight Files) on Thumb-Drive to FP&C & User Agency (Designer's Responsibility)

ROOF COMPLETION INFORMATION

Facility Name: _____ Building Name: _____

Site Code: _____ State I.D.: _____ Project No. & WBS: _____

☐ New Roof ☐ Total Replacement ☐ Partial Replacement Roof Section(s): _____

☐ Roof Plan Attached (required)

Roof Type:

1. SBS Mod. Bit.
2. PVC
3. TPO
4. Metal
5. Tile
6. Shingle
7. Cedar Shake
8. _____

Surfacing Type:

1. Ceramic Granules
2. Smooth Uncoated
3. Modified Asphalt
4. Silicone
5. Acrylic
6. Urethane
7. Aluminum
8. Pre-Finished Paint
9. _____

Connection Type:

1. Cold Process
2. Hot Asphalt
3. Torched Asphalt
4. Mechanical Fastener
5. _____

Drainage Type:

1. Over the Edge
2. Roof Drains
3. Perimeter Gutter
4. Internal Gutter
5. _____

Total Penetrations:

Slope:

1. 1/4 in./ft.
2. 1/8 in./ft.
3. 1/2 in./ft.
4. _____

Deck Type:

1. Structural Concrete
2. Gypsum
3. Metal
4. Lt. Wt. Concrete
5. Cement Fiber
6. Wood
7. _____

Insulation:

1. Polyisocyanurate
2. Cover Board
3. Fiberglass
4. Wood Fiber
5. _____

No. of Plies:

Insulation Thickness:

Roof Area (sq. ft.)

Roofing Contractor (2-Year State Guarantee):

Address: _____

Roofing Contractor's Telephone: _____

Roofing Contractor's Email: _____

Warranty Beginning Date:
(same as Acceptance Date)

Warranty Ending Date: _____

Roofing Manufacturer (20-Year State Warranty):

Address: _____

Roofing Manufacturer's Telephone: _____

Roofing Manufacturer's Email: _____

Roof Warranty Number: _____

Beginning Date:
(same as Acceptance Date)

Ending Date: _____

Facility Planning & Control

15. PRE-CONSTRUCTION CONFERENCE AGENDA

As a minimum, the following items are to be covered in the pre-construction conference. The Designer may, at his discretion, add additional items which he feels are important to this particular project.

1. Contractor shall furnish the following prior to his first payment:

- a. Cost breakdown (Schedule of Values), shall be in standard Construction Specifications Institute format.
- b. List Sub-contractors and major suppliers
- c. Information listed in Paragraph 7.1 of the Supplementary Conditions.
- d. Construction Schedule as defined in 3.10.2 of General Conditions and Supplementary Conditions.

No payments to the contractor shall be made until this information is provided.

2. Roles of Individuals:

- a. **Designer** – shall be solely responsible for the direction of the project. The Designer shall keep minutes of all meetings, including construction progress meetings, and distribute within 7 days. All instructions to contractor shall come from the designer. All decisions and directions shall be in writing. Verbal instructions shall be immediately confirmed in writing. The Designer and his principal consultants shall visit the project regularly according to the requirements of the Louisiana Capital Improvement Projects Procedure Manual for Design and Construction. The Designer shall NOT assume the role of his principal consultants in site visits. Copies of Designer Site Visit Reports are to be sent to Facility Planning and Control and the User Agency on a weekly basis.
- b. **Facility Planning and Control** - Designer to receive instructions only from Facility Planning and Control. Program or design changes shall be approved by Facility Planning and Control prior to any work being performed by the Designer.
- c. **User Agency** - Address all requests for changes through Facility Planning and

Control. Establish ground rules for the contractor and his personnel while working on

their premises. If representatives of Facility Planning & Control or the using agency find any discrepancies, they believe to be contrary to the Contract Documents, they shall notify the designer. If it is thought that discrepancy needs immediate attention, the individual discovering the discrepancy and the contractor's representative should call the designer for immediate resolution.

- d. **Contractor** - Work shall be according to the Contract Documents, not necessarily standard practice. Emergency action to protect life or property shall be taken immediately by the superintendent on the site. Less urgent action shall be resolved by telephone among the appropriate parties. Fire Marshal approved documents shall be accessible at all times at the project site, in accordance with Fire Marshal requirements. Approved documents from all other applicable regulatory agencies shall also be accessible at all times at the project site.

3. Change Orders:

All requests for a change in time and/or money shall be submitted to the designer, with proper back up data, for his review. The designer shall submit the Change Order to Facility Planning and Control with his recommendation of action required. The Change Order shall be approved by FP&C prior to any additional work being performed.

- a. Change Orders cannot be approved without the proper breakdown as required by the Supplementary Conditions, Section 7.2. The same requirements apply to time extension requests.
- b. Facility Planning and Control needs only the original and one (1) copy of backup.
- c. Change Orders should be rounded to the nearest whole dollar amount.
- d. User paid change orders are **not** allowed.

- e. User requested change orders are to be avoided.

4. Invoice Procedure:

- a. Invoices may be submitted in electronic format.
 - 1) Contractor shall submit one Certificate for Payment directly to the Designer. Facility Planning and Control – Application and Certification for Payment forms shall be used for submittal. Certificate for payment need **not** be notarized.
 - 2) After review, the Designer shall process the Certificate as promptly as possible, in any case within seven (7) days. If a Certificate is held for any reason, written notice stating the reason for delay should be given the owner and the contractor. If a Certificate is changed for any reason, changes will be made to all copies.
 - 3) Distribution of copies shall be as follows:
 - a) Designer forwards one Certificate for Payment directly to Facility Planning and Control with a transmittal letter/memo.
 - b) Designer forwards copy of transmittal letter and one (1) copy of Certificate to Contractor. One (1) copy retained for Designer records. One (1) copy sent to User Agency.
- b. During construction, designer's invoices shall be sent directly to Facility Planning & Control.
- c. If federal funds are involved, compliance with additional regulations is required including but not limited to:
 - Davis Bacon Act - Wage rate & payroll records.
 - Drug Free Workplace Act
 - Civil Rights EOP poster with name of EOP person shown.
- d. Stored Materials must be on site for payment to be made. Payment will not be made for materials stored in a bonded warehouse or elsewhere.
- e. An Original 45 Day Clear Lien and an Original Consent of Surety (AIA Form G707) is

required prior to final payment to the contractor.

5. Prior Approval:

Only items as specified or prior approved in accordance with the Contract Documents will be incorporated into the project. Approval of shop drawings does not relieve Contractor of complying with the Prior Approval clause.

6. Testing Lab:

- a. The Owner will engage and pay for the testing laboratory if required. If the Contractor obtains the services of a testing laboratory, he will be responsible for all costs for that laboratory
- b. Designer should furnish Testing Lab with written notice of types and frequency of required tests. Set up procedure for Testing Lab notification.
- c. No off site testing unless called for in the Contract Documents.
- d. Facility Planning and Control will pay a minimum of standby time. Contractor may be billed if not well controlled.
- e. Testing Lab invoices shall be submitted by hardcopy or in electronic format through the Designer, who in turn acknowledges their recognition of services submitted.

7. Project Sign

When a project sign is specified, select location.

8. Meetings:

Establish a time and place for the Monthly Meeting. Designer shall notify FP&C prior to and provide minutes of all meetings to all participants within 7 days.

9. Roofing:

Pre-roofing Conference - establish a direct line of communication, iron out initial questions regarding the project and to review project submittal requirements. This conference should be held shortly after award of the roofing contract and a minimum of six (6) weeks prior to the anticipated start of roofing. Attendance by general contractor,

roofing subcontractor and manufacturer's representative is required. A letter from the manufacturer stating the roofer is an approved applicator and sample warranties shall be submitted at the Pre-roofing Conference, if not before.

- a. General Guidelines for Low Sloped Roofs
 - 1) Details in compliance with NRCA and Roof Manufacturer
 - 2) Concrete Decks are to be primed.
 - 3) Nailable Decks; Red Rosin sheet is required on wood decks.
 - 4) Fastening per manufacturer's requirements to comply with I-90 FM rating.
 - 5) Asphalt
 - a) Type IV asphalt shall be used for all modified bitumen mop-down systems
 - b) Temperature at the point of application shall be the EVT temperature plus or minus 25 degrees.
 - 6) Insulation
 - a) All wet insulation is to be rejected and removed from the site.
 - b) All insulation joints shall be staggered, including daily tie-ins.
 - 7) Metal
 - a) Color Selection
 - b) Gravel guard - use minimal raised lip for areas where drainage is over the edge.
 - 8) Drainage: Most guarantees prohibit water remaining on the roof more than 48 hours.
 - 9) Roofing guarantees
 - a) No dollar limit. Guarantee system from the deck up, naming all products within the system.
 - b) No language about "no pay, no guarantee".
 - c) Warranty start date to be on or very near date of Acceptance of Building Contract. The roofing warranty required for his project must meet the requirements of FP&C. It is important that the roofing manufacturer and applicator are aware of this. An incomplete or incorrect warranty **will** delay acceptance.
 - d) Supplementary Conditions Section 13.3.3, the Nineteenth Judicial Court in and for the Parish of East Baton Rouge, State of Louisiana shall have sole

jurisdiction in any action brought under this contract.

- 10) Manufacturer's specification to be used in support of designer's specification. Manufacturer's requirements are a minimum, use designer's specification if it exceeds.

- 11) Track weather days including predicted rain percentage. Submit to designer monthly with pay estimate.

Pre-application Conference to verify readiness of the project structure, review assignments of Preliminary Conference, scan last minute details, changes or corrections and to review the anticipated schedule of progress. This conference should be held within one (1) week of roofing application. Attendance by general contractor, roofing subcontractor and superintendent or foreman and manufacturer's representative is required.

Representatives of the designer and FP&C shall be visiting the site to make sure the roof is being installed per the manufacturers' requirements and the Contract Documents. If found not in compliance, tests and corrective measures may be required to prove the roof is acceptable. Tests include Blow-Off Testing, etc.

Moisture Survey - When installation is complete, FP&C will arrange to have a moisture survey performed. Deficiencies will be noted, either on the roof with paint or on roof plan drawing or both. After these deficiencies are corrected, this office will arrange to have these areas resurveyed. If these deficiencies are found not to be corrected and additional survey time is required, then the cost of this time will be assessed against the contractor at a rate of \$50.00 per hour through a credit change order.

Designer: Please fill out "Roof Completion Information" form and submit it with the Recommendation of Acceptance. If the roofed section is new, a scaled drawing is also needed. Preferably, this drawing would be on AutoCAD in compliance with the layers specified in our "Instructions to Designers."

10. General Correspondence:

- a. Project Number must be on all correspondence.

b. Contractor shall copy Facility Planning and Control on any correspondence if:

- 1) It involves a controversial issue.
- 2) It relates to information requests to the Designer that had not been furnished in a timely manner.

11. Miscellaneous Items to be Discussed as Necessary:

- a. Shop drawings, samples, hardware, and color schedules. Shop drawings submitted to the user by the designer are for record purposes only, not for approval. Approval is the sole responsibility of the designer.
COLOR SELECTION: If the User does not approve color selections in a timely manner, the Designer, in consultation with FP&C, shall make the selections, which will be final.
- b. Establish the location and type of temporary facilities and utilities. Establish how payment for temporary utilities will be made and how costs will be tracked?
- c. Outages/Interruptions of Services. Contractor is to request, in writing, all outages/interruptions to the User. The amount of advance notice is to be determined by the user. Coordination of outages or interruptions is the responsibility of the contractor
- d. Contractor use/access to pertinent buildings and facilities.
- e. Location of staging area and/or fencing.
- f. Site and stored material security is the contractor's responsibility.
- g. Use of site, parking of vehicles, decals and/or permits for parking
- h. The User shall have first refusal of salvaged materials. Where are they to be delivered? The contractor is responsible for the disposition of all other materials in accordance with laws and regulations.

- i. Safety and First Aid. This is the contractor's responsibility.
- j. Procedure for keeping Record Documents. Contractor to record as-built information that varies from the contract documents, on (1) one set of prints, to be furnished to the Designer at completion of the job. As-builts are prepared by Designer, inclusive of Supplemental Drawings, the Contractor, based on the as-built work and the required adjustments to the contract documents and the change orders, and shall be submitted timely to Facility Planning and Control. Plans shall be marked "**AS-BUILT**". As-built drawings submitted to FP&C shall consist of (2) two full size paper sets of Record Drawings (As-Built) prepared by the Designer. Also required are (2) two disks or flash drives of As-built drawings in AutoCAD (.dwg) and .pdf format, including electronic copies of the bid specifications and addenda. Acceptable As-builts are required prior to the Designer's final payment.
- k. Use of any Asbestos Containing materials is prohibited.
- l. Pictures or videos of existing conditions may be made.
- m. Near the end of the project the FP&C Project Manager will review the work to determine compliance with FP&C's ADA Non-Comprehensive Field Checklist. Any accessibility problems identified in this review shall be corrected before the project can be considered complete.

12. Pre-Close Out Conference

When the project reaches 75 to 80% completion the Designer will schedule a meeting with the Contractor, FP&C and the User to review the requirements and procedures for the Final Inspection and Acceptance.

Facility Planning & Control

16. PRE-CLOSEOUT CONFERENCE AGENDA

As a minimum, the following items are to be covered in the pre-Closeout conference. The Designer may, at his/her discretion, add additional items which he/she feels are important to this particular project.

As the subject project nears completion, you should be reminded of several requirements pertaining to acceptance of Facility Planning & Control projects, including:

- A. Notify the local Fire Marshal's Office of the date and time of the Punch List Inspection. This must be done at least 7 days prior to the scheduled date. To issue an occupancy permit the Fire Marshal will require several certifications, including:
 - 1. Designer submitted Certificate of Completion (Fire Marshal form)
 - 2. Sprinkler certification
 - 3. Fire Alarm certification
 - 4. Fire Extinguishers inspected and tagged by licensed contractor (unless invoice shows they are less than one year old.)
 - 5. Elevator certification
 - 6. Boiler Inspection
 - 7. All hot water heaters of 50 or more gallon capacity must be inspected (usually handled by the User)
- B. All equipment should be operating and instructions on usage given immediately to the User Agency. Withhold Punch List monies for this requirement.
 - 1. Elevators are to be inspected by a representative of the Office of Risk Management.
- C. Note that the 5 or 10% Retainage is only for liens. A separate amount must be withheld for Punch List work. If the value of the Punch List equals more than the funds remaining in the project, Acceptance must be delayed until the punch list value is reduced to the amount of remaining funds. The Designer shall provide the values for each item on the punch list in accordance with R.S. 38:2248(B).
- D. On deeming the project to be "substantially complete", the designer will complete and submit to FP&C, the Recommendation of Acceptance. FP&C will send the "NOTICE OF ACCEPTANCE OF BUILDING CONTRACT" to the contractor. This is the form to be filed in the courthouse. The 45-day lien period will not start until this document is filed. See Item (E).
- E. No project shall be accepted until both the Manufacturer's Roofing Warranty and the Contractor's Roofing Warranty are submitted and found to be in compliance with the requirements of the Contract Documents. In addition, please complete our Roof Completion Information form with a Roof Plan on 8-1/2"x11" of Individual State ID's or different Material Roof (or have the roofer complete it.) A copy of the blank form can be obtained from Facility Planning and Control.

FPC's standard Membrane and Metal Roofing Warranties shall be utilized (as applicable per project type).
- F. The User Agency should provide a letter of concurrence prior to Acceptance.
- G. Facility Planning & Control shall not approve payment of the 5% or 10% retainage without:
 - 1. An invoice approved by the designer,
 - 2. Original Consent of Surety to Final Payment (AIA Form G707),
 - 3. Original Clear Lien Certificate showing that 45 days have elapsed since the Notice of Acceptance was filed with the Clerk of Court. Note that, in obtaining the clear lien certificate, the contractor should ensure

that the full forty-five (45) days have passed and that the forty-fifth day is not a legal holiday as legal holidays can extend the lien period. Clear lien certificates obtained on the forty-fifth day are not acceptable.

H. Facility Planning & Control requires certification by the designer that the punch listed work has been completed prior to any payment of money withheld for the Punch List. If the Punch List is not completed within 45 days after Acceptance, the contractor may be placed in default. Contractor must be paid for all punch list work completed by the end of the 45 day lien period at the end of the 45 day lien period.

I. As-builts, prepared in accordance with the General Instructions to Designers, must be submitted and approved prior to the Designer

receiving Final Payment. Contractor to record as-built information that varies from the contract documents, on (1) one set of prints, to be furnished to the Designer at completion of the job.

J. The Designer shall bring to the attention of the Contractor all deficiencies as soon as they are discovered and shall **NOT** wait until the punch list is prepared.

K. Near the end of the project the FP&C Project Manager will review the project to determine compliance with FP&C's ADA Non-Comprehensive Field Checklist. Any accessibility problems identified in this review shall be corrected before the project can be considered complete.

NOTES:

ADVERTISEMENT FOR BIDS

Sealed bids will be received for the State of Louisiana by the Division of Administration and shall be directed to the Office of Facility Planning and Control, 1201 North Third Street, Claiborne Office Building, Suite 7-160, Baton Rouge, Louisiana, 70802 or P.O. Box 94095, Baton Rouge, Louisiana, 70804-9095. The deadline for receipt of bids is 2:00 PM on _____, 20____, at which time bids will be opened and read aloud in a public meeting in the Claiborne Office Building, Conference Room 1-145.

FOR: School of Construction Practice Lab Building
University of Louisiana Monroe
Monroe, Louisiana

PROJECT NUMBER:
19-629-23-01, F.19002614

Complete Bid Documents for this project are available in electronic form. They may be obtained without charge and without deposit from AEPlans (aeplans.com). Printed copies are not available from the Designer, but arrangements can be made to obtain them through most reprographic firms. Plan holders are responsible for their own reproduction costs. Questions about this procedure shall be directed to the Designer at:

Timothy M. Brandon Architect,
103 Cypress Street, West Monroe, LA 71291
Telephone: (318)340-1550
Email: kbrandon@tbastudio.com

All bids shall be accompanied by bid security in an amount of five percent (5.0%) of the sum of the base bid and all alternates. The form of this security shall be as stated in the Instructions to Bidders included in the Bid Documents for this project.

The successful Bidder shall be required to furnish a Performance and Payment Bond written as described in the Instructions to Bidders included in the Bid Documents for this project.

A PRE-BID CONFERENCE WILL BE HELD

at time on day, date at location

Bids shall be accepted from Contractors who are licensed under LA. R.S. 37:2150-2192 for the classification of **Building Construction**. Bidder is required to comply with provisions and requirements of LA R.S. 38:2212(B)(5). No bid may be withdrawn for a period of forty-five (45) days after receipt of bids, except under the provisions of LA. R.S. 38:2214.

The Owner reserves the right to reject any and all bids for just cause. In accordance with La. R.S. 38:2212(B)(1), the provisions and requirements of this Section; and those stated in the bidding documents shall not be waived by any entity.

When this project is financed either partially or entirely with State Bonds or financed in whole or in part by federal or other funds which are not readily available at the time bids are received, the award of this Contract is contingent upon the granting of lines of credit, or the sale of bonds by the Bond Commission or the availability of federal or other funds. The State shall incur no obligation to the Contractor until the Contract Between Owner and Contractor is fully executed.

Facility Planning and Control is a participant in the Small Entrepreneurship (SE) Program (the Hudson Initiative) and the Veteran-Owned and Service-Connected Disabled Veteran-Owned (LaVet) Small Entrepreneurships Program. Bidders are encouraged to consider participation. Information is available from the Office of Facility Planning and Control or on its website at <https://www.doa.la.gov/doa/fpc/>.

If you have a disability and would like to request an accommodation in order to participate in this meeting, please contact Christina Cardona at Christina.Cardona@la.gov or (225) 342-6060 as soon as possible but no later than 48 hours before the scheduled meeting.

STATE OF LOUISIANA
DIVISION OF ADMINISTRATION
FACILITY PLANNING AND CONTROL
MATTHEW H. BAKER, DIRECTOR

OCTOBER 2025

INSTRUCTIONS TO BIDDERS

COMPLETION TIME:

The Bidder shall agree to fully complete the contract within (420) consecutive calendar days, subject to such extensions as may be granted under Paragraph 8.3, in the General Conditions and the Supplementary Conditions, and acknowledges that this construction time will start on or before the date specified in the written “Notice to Proceed” from the Owner.

LIQUIDATED DAMAGES:

The Bidder shall agree to pay as Liquidated Damages the amount of (twelve hundred) Dollars (\$ 1,200.00) for each consecutive calendar day for which the work is not complete, beginning with the first day beyond the contract completion date stated on the “Notice to Proceed” or as amended by change order.

TAX EXEMPTION:

The project is to be exempt from sales and use taxes imposed by any taxing authority. The successful contractor / subcontractors will be required to submit the appropriate tax exemption form R-85012-T (Public Projects Contractor / Subcontractor: Sales Tax Certification and Exemption Application – Louisiana Revised Statute 47:305.7(A)(1)(b)) to the Louisiana Department of Revenue for each contract / subcontract associated with the work.

ARTICLE 1

DEFINITIONS

1.1 The Bid Documents include the following:

Advertisement for Bids
Instructions to Bidders
Bid Form
Bid Bond
General Conditions of the Contract for Construction,
AIA Document A201, 2017 Edition
Supplementary Conditions
Contract Between Owner and Contractor and Performance and Payment Bond Affidavit
User Agency Documents (if applicable)
Change Order Form
Partial Occupancy Form
Recommendation of Acceptance
Asbestos Abatement (if applicable)
Other Documents (if applicable)
Specifications & Drawings
Addenda issued during the bid period and acknowledged in the Bid Form

1.2 All definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201 and the Supplementary Conditions are applicable to the Bid Documents.

1.3 Addenda are written and/or graphic instruments issued by the Architect prior to the opening of bids, which modify or interpret the Bid Documents by additions, deletions, clarifications, corrections and prior approvals.

1.4 A bid is a complete and properly signed proposal to do the work or designated portion thereof for the sums stipulated therein supported by data called for by the Bid Documents.

1.5 Base bid is the sum stated in the bid for which the Bidder offers to perform the work described as the base, to which work may be added, or deleted for sums stated in alternate bids.

1.6 An alternate bid (or alternate) is an amount stated in the bid to be added to the amount of the base bid if the corresponding change in project scope or materials or methods of construction described in the Bid Documents is accepted.

1.7 A Bidder is one who submits a bid for a prime Contract with the Owner for the work described in the Bid Documents.

1.8 A Sub-bidder is one who submits a bid to a Bidder for materials and/or labor for a portion of the work.

1.9 Where the word "Architect" is used in any of the documents, it shall refer to the Prime Designer of the project, regardless of discipline.

ARTICLE 2

PRE-BID CONFERENCE

2.1 A Pre-Bid Conference shall be held at least 10 days before the date for receipt for bids. The Architect shall coordinate the setting of the date, time and place for the Pre-Bid Conference with the User Agency and shall notify in writing the Owner and all who have received sets of the Bid Documents to attend. The purpose of the Pre-Bid Conference is to familiarize Bidders with the requirements of the Project and the intent of the Bid Documents, and to receive comments and information from interested Bidders. If the Pre-Bid Conference is stated in the Advertisement for Bids to be a Mandatory Pre-Bid Conference, bids shall be accepted only from those bidders who attend the Pre-Bid Conference. Contractors who are not in attendance for the **entire** Pre-Bid Conference will be considered to have not attended.

2.2 Any revision of the Bid Documents made as a result of the Pre-Bid Conference shall not be valid unless included in an addendum.

ARTICLE 3

BIDDER'S REPRESENTATION

3.1 Each Bidder by making his bid represents that:

3.1.1 He has read and understands the Bid Documents and his bid is made in accordance therewith.

3.1.2 He has visited the site and has familiarized himself with the local conditions under which the work is to be performed.

3.1.3 His bid is based solely upon the materials, systems and equipment described in the Bid Documents as advertised and as modified by addenda.

3.1.4 His bid is not based on any verbal instructions contrary to the Bid Documents and addenda.

3.1.5 He is familiar with Code of Governmental Ethics requirement that prohibits public servants and/or their immediate family members from bidding on or entering into contracts; he is aware that the Designer and its principal owners are considered Public Servants under the Code of Governmental Ethics for the limited purposes and scope of the Design Contract with the State on this Project (see Ethics Board Advisory Opinion, No. 2009-378 and 2010-128); and neither he nor any principal of the Bidder with a controlling interest therein has an immediate family relationship with the Designer or any principal within the Designer's firm (see La. R.S. 42:1113). Any Bidder submitting a bid in violation of this clause shall be disqualified and any contract entered into in violation of this clause shall be null and void.

3.2 The Bidder must be fully qualified under any State or local licensing law for Contractors in effect at the time and at the location of the work before submitting his bid. In the State of Louisiana, Revised Statutes 37:2150, et seq. will be considered, if applicable.

The Contractor shall be responsible for determining that all of his Sub-bidders or prospective Subcontractors are duly licensed in accordance with law.

ARTICLE 4

BID DOCUMENTS

4.1 Copies

4.1.1 Bid Documents may be obtained from the Architect for a deposit as stated in the Advertisement for Bids. The deposit will be refunded as stated in the Advertisement for Bids. No deposits will be refunded on Bid Documents returned later than ten days after receipt of bids.

4.1.1.2 As an alternative method of distribution, the Designer may provide the Bid Documents in electronic format. They may be obtained without

charge and without deposit as stated in the Advertisement for Bids.

4.1.1.2.1 If electronic distribution is available, printed copies will not be available from the Designer, but arrangements can be made to obtain them through most reprographic firms and/or plan rooms.

4.1.1.2.2 If electronic distribution is not available, the reproduction cost on the first paper plan set acquired by bona fide prime bidders will be fully refunded by the Designer upon delivery of the documents to the Designer in good condition no later than ten days after receipt of bids.

4.1.1.2.3 If electronic distribution is available, all other plan holders are responsible for their own reproduction costs.

4.1.2 Complete sets of Bid Documents shall be used in preparing bids; neither the Owner nor the Architect assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bid Documents.

4.1.3 The Owner or Architect in making copies of the Bid Documents available on the above terms, do so only for the purpose of obtaining bids on the work and do not confer a license or grant for any other use.

4.2 Interpretation or Correction of Bid Documents

4.2.1 Bidders shall promptly notify the Architect of any ambiguity, inconsistency or error which they may discover upon examination of the Bid Documents or of the site and local conditions.

4.2.2 Bidders requiring clarification or interpretation of the Bid Documents shall make a written request to the Architect, to reach him at least seven days prior to the date for receipt of bids.

4.2.3 Any interpretation, correction or change of the Bid Documents will be made by addendum. Interpretations, corrections or changes of the Bid Documents made in any other manner will not be binding and Bidders shall not rely upon such interpretations, corrections and changes.

4.3 Substitutions

4.3.1 The materials, products and equipment described in the Bid Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. No substitutions shall be allowed after bids are received.

4.3.2 No substitution will be considered unless written request for approval has been submitted by the Proposer and has been received by the Architect at least fourteen (14) working days prior to the opening of bids. (La. R.S. 38:2295(C)) Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including model numbers, drawings, cuts, performance and test data and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or work that incorporation of the substitute would require shall be included. It shall be the responsibility of the proposer to include in his proposal all changes required of the Bid Documents if the proposed product is used. Prior approval, if given, is contingent upon supplier being responsible for any costs which may be necessary to modify the space or facilities needed to accommodate the materials and equipment approved.

4.3.3 If the Architect approves any proposed substitution, such approval shall be set forth in an addendum. Bidders shall not rely upon approvals made in any other manner.

4.4 Addenda

4.4.1 Addenda will be transmitted to all who are known by the Architect to have received a complete set of Bid Documents.

4.4.2 Copies of addenda will be made available for inspection wherever Bid Documents are on file for that purpose.

4.4.3 Except as described herein, addenda shall not be issued within a period of seventy-two (72) hours prior to the advertised time for the opening of bids, excluding Saturdays, Sundays, and any other legal holidays. If the necessity arises of issuing an addendum modifying plans and specifications within the seventy-two (72) hour period prior to the

advertised time for the opening of bids, then the opening of bids shall be extended at least seven but no more than twenty-one (21) working days, without the requirement of re-advertising. Facility Planning shall be consulted prior to issuance of such an addendum and shall approve such issuance. The revised time and date for the opening of bids shall be stated in the addendum.

4.4.4 Each Bidder shall ascertain from the Architect prior to submitting his bid that he has received all addenda issued, and he shall acknowledge their receipt on the Bid Form.

4.4.5 The Owner shall have the right to extend the bid date by up to (30) thirty days without the requirement of re-advertising. Any such extension shall be made by addendum issued by the Architect.

ARTICLE 5

BID PROCEDURE

5.1 Form and Style of Bids

5.1.1 Bids shall be submitted on the Louisiana Uniform Public Work Bid Form provided by the Architect for this project.

5.1.2 The Bidder shall ensure that all applicable blanks on the bid form are completely and accurately filled in.

5.1.3 Bid sums shall be expressed in both words and figures, and in case of discrepancy between the two, the written words shall govern.

5.1.4 Any interlineation, alteration or erasure must be initialed by the signer of the bid or his authorized representative.

5.1.5 Bidders are cautioned to complete all alternates should such be required in the Bid Form. Failure to submit alternate prices will render the bid non responsive and shall cause its rejection.

5.1.6 Bidders are cautioned to complete all unit prices should such be required in the Bid Form. Unit prices represent a price proposal to do a specified quantity and quality of work. Unit prices are incorporated into the base bid or alternates, as

indicated on the Unit Price Form, but are not the sole components thereof.

5.1.7 Bidder shall make no additional stipulations on the Bid Form nor qualify his bid in any other manner.

5.1.8 Written evidence of the authority of the person signing the bid for the public work shall be submitted in accordance with La. R.S. 38:2212 (B)(5).

5.1.9 On any bid in excess of fifty thousand dollars (\$50,000.00), the Contractor shall certify that he is licensed under La. R.S. 37: 2150-2173 and show his license number on the bid above his signature or his duly authorized representative.

5.2 Bid Security

5.2.1 No bid shall be considered or accepted unless the bid is accompanied by bid security in an amount of five percent (5.0%) of the base bid and all alternates.

The bid security shall be in the form of a certified check or cashier's check drawn on a bank insured by the Federal Deposit Insurance Corporation, or a Bid Bond written by a surety company licensed to do business in Louisiana and signed by the surety's agent or attorney-in-fact. The Bid Bond shall be written on the Facility Planning and Control Bid Bond Form, and the surety for the bond must meet the qualifications stated thereon. The Bid Bond shall include the legal name of the bidder be in favor of the State of Louisiana, Division of Administration, Office of Facility Planning and Control, and shall be accompanied by appropriate power of attorney. The Bid Bond must be signed by both the bidder/principal and the surety in the space provided on the Facility Planning and Control Bid Bond Form. Failure by the bidder/principal or the surety to sign the bid bond shall result in the rejection of the bid.

Bid security furnished by the Contractor shall guarantee that the Contractor will, if awarded the work according to the terms of his proposal, enter into the Contract and furnish Performance and Payment Bonds as required by these Bid Documents, within fifteen (15) days after written notice that the instrument is ready for his signature.

Should the Bidder refuse to enter into such Contract or fail to furnish such bonds, the amount of

the bid security shall be forfeited to the Owner as liquidated damages, not as penalty.

5.2.2 The Owner will have the right to retain the bid security of Bidders until either (a) the Contract has been executed and bonds have been furnished, or (b) the specified time has elapsed so that bids may be withdrawn, or (c) all bids have been rejected.

5.3 Submission of Bids

5.3.1 The Bid shall be sealed in an opaque envelope. The bid envelope shall be identified on the outside with the name of the project, and the name, address, and license number of the Bidder.

The envelope shall not contain multiple bid forms, and will be received until the time specified and at the place specified in the Advertisement for Bids. It shall be the specific responsibility of the Bidder to deliver his sealed bid to Facility Planning and Control Department at the appointed place and prior to the announced time for the opening of bids. Late delivery of a bid for any reason, including late delivery by United States Mail, or express delivery, shall disqualify the bid.

If the bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "Bid Enclosed" on the face thereof. Such bids shall be sent by Registered or Certified Mail, Return Receipt Requested, addressed to:

Facility Planning and Control,
P. O. Box 94095
Baton Rouge, Louisiana, 70804-9095.

Bids sent by express delivery shall be delivered to:
Facility Planning and Control
Suite 7-160
Claiborne Office Building
1201 North Third Street
Baton Rouge, Louisiana 70802

5.3.2 Bids shall be deposited at the designated location prior to the time on the date for receipt of bids indicated in the Advertisement for Bids, or any extension thereof made by addendum. Bids received after the time and date for receipt of bids will be returned unopened.

5.3.3 Bidder shall assume full responsibility for timely delivery at location designated for receipt of bids.

5.3.4 Oral, telephonic or telegraphic bids are invalid and shall not receive consideration. Owner shall not consider notations written on outside of bid envelope which have the effect of amending the bid. Written modifications enclosed in the bid envelope, and signed or initialed by the Contractor or his representative, shall be accepted.

5.4 Modification or Withdrawal of Bid

5.4.1 A bid may not be modified, withdrawn or canceled by the Bidder during the time stipulated in the Advertisement for Bids, for the period following the time and bid date designated for the receipt of bids, and Bidder so agrees in submitting his bid, except in accordance with R.S. 38:2214 which states, in part, "Bids containing patently obvious, unintentional, and substantial mechanical, clerical, or mathematical errors, or errors of unintentional omission of a substantial quantity of work, labor, material, or services made directly in the compilation of the bid, may be withdrawn by the contractor if clear and convincing sworn, written evidence of such errors is furnished to the public entity within forty-eight hours of the bid opening excluding Saturdays, Sundays, and legal holidays".

5.4.2 Prior to the time and date designated for receipt of bids, bids submitted early may be modified or withdrawn only by notice to the party receiving bids at the place and prior to the time designated for receipt of bids.

5.4.3 Withdrawn bids may be resubmitted up to the time designated for the receipt of bids provided that they are then fully in conformance with these Instructions to Bidders.

5.4.4 Bid Security shall be in an amount sufficient for the bid as modified or resubmitted.

5.5 Prohibition of Discriminatory Boycotts of Israel

By submitting a bid, the bidder certifies and agrees that the following information is correct:

In preparing its bid, the bidder has considered all proposals submitted from qualified, potential subcontractors and suppliers, and has not, in the solicitation, selection, or commercial treatment of

any subcontractor or supplier, refused to transact or terminated business activities, or taken other actions intended to limit commercial relations, with a person or entity that is engaging in commercial transactions in Israel or Israel-controlled territories, with the specific intent to accomplish a boycott or divestment of Israel. The bidder has also not retaliated against any person or other entity for reporting such refusal, termination, or commercially limiting actions. The state reserves the right to reject any bid if this certification is subsequently determined to be false and to terminate any contract awarded based on such a false response.

ARTICLE 6

CONSIDERATION OF BIDS

6.1 Opening of Bids

6.1.1 The properly identified Bids received on time will be opened publicly and will be read aloud, and a tabulation abstract of the amounts of the base bids and alternates, if any, will be made available to Bidders.

6.2 Rejection of Bids

6.2.1 The Owner shall have the right to reject any or all bids and in particular to reject a bid not accompanied by any required bid security or data required by the Bid Documents or a bid in any way incomplete or irregular.

6.3 Acceptance of Bid

6.3.1 It is the intent of the Owner, if he accepts any alternates, to accept them in the order in which they are listed in the Bid Form. Determination of the Low Bidder shall be on the basis of the sum of the base bid and the alternates accepted. However, the Owner shall reserve the right to accept alternates in any order which does not affect determination of the Low Bidder.

ARTICLE 7

POST-BID INFORMATION

7.1 Submissions

7.1.1 At the Pre-Construction Conference, the Contractor shall submit the following information to the Architect.

7.1.1.1 A designation of the work to be performed by the Contractor with his own forces.

7.1.1.2 A breakdown of the Contract cost attributable to each item listed in the Schedule of Values Form (attached). No payments will be made to the Contractor until this is received.

7.1.1.3 The proprietary names and the suppliers of principal items or systems of material and equipment proposed for the work.

7.1.1.4 A list of names and business domiciles of all Subcontractors, manufacturers, suppliers or other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the work. It is the preference of the Owner that, to the greatest extent possible or practical, the Contractor utilize Louisiana Subcontractors, manufacturers, suppliers and labor.

7.1.2 The General Contractor shall be responsible for actions or inactions of Subcontractors and/or material suppliers.

The General Contractor is totally responsible for any lost time or extra expense incurred due to a Subcontractor's or Material Supplier's failure to perform. Failure to perform includes, but is not limited to, a Subcontractor's financial failure, abandonment of the project, failure to make prompt delivery, or failure to do work up to standard. Under no circumstances shall the Owner mitigate the General Contractor's losses or reimburse the General Contractor for losses caused by these events.

7.1.3 The lowest responsive and responsible bidder shall submit to the Architect and the Owner within ten days after the bid opening a letter/letters from the manufacturer stating that the manufacturer will issue the roof system guarantee complying with the requirements of Facility Planning and Control based on the specified roof system and include the name of the applicator acceptable to the manufacturer at the highest level of certification for installing the specified roof system. This manufacturer shall be

one that has received prior approval or is named in the specifications.

In accordance with La. R.S. 38:2227 [references La R.S. 38:2212(A)(3)(c)(ii), which has since been renumbered as La R.S. 38:2212(B)(3)], La. R.S. 38:2212.10 and La. R.S. 23:1726(B) the apparent low bidder on this project shall submit the completed Attestations Affidavit (Past Criminal Convictions of Bidders, Verification of Employees and Certification Regarding Unpaid Workers Compensation Insurance) form found within this bid package to Facility Planning and Control within 10 days after the opening of bids.

ARTICLE 8

PERFORMANCE AND PAYMENT BOND

8.1 Bond Required

8.1.1 The Contractor shall furnish and pay for a Performance and Payment Bond written by a company licensed to do business in Louisiana, which shall be signed by the surety's agent or attorney-in-fact, in an amount equal to 100% of the Contract amount. Surety must be listed currently on the U. S. Department of Treasury Financial Management Service List (Treasury List) as approved for an amount equal to or greater than the contract amount, or must be an insurance company domiciled in Louisiana or owned by Louisiana residents. If surety is qualified other than by listing on the Treasury list, the contract amount may not exceed fifteen percent of policyholders' surplus as shown by surety's most recent financial statements filed with the Louisiana Department of Insurance and may not exceed the amount of \$500,000. However, a Louisiana domiciled insurance company with at least an A- rating in the latest printing of the A. M. Best's Key Rating Guide shall not be subject to the \$500,000 limitation, provided that the contract amount does not exceed ten percent of policyholders' surplus as shown in the latest A. M. Best's Key Rating Guide nor fifteen percent of policyholders' surplus as shown by surety's most recent financial statements filed with the Louisiana Department of Insurance. The Bond shall be signed by the surety's agent or attorney-in-fact. The Bond shall be in favor of the

State of Louisiana, Office of Facility Planning and Control.

8.2 Time of Delivery and Form of Bond

8.2.1 The Bidder shall deliver the required bond to the Owner simultaneous with the execution of the Contract.

8.2.2 Bond shall be in the form furnished by Facility Planning and Control, entitled CONTRACT BETWEEN OWNER AND CONTRACTOR AND PERFORMANCE AND PAYMENT BOND, a copy of which is included in the Bid Documents.

8.2.3 The Bidder shall require the Attorney-in-Fact who executes the required bond on behalf of the surety to affix thereto a certified and current copy of his power of Attorney.

ARTICLE 9

FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

9.1 Form to be Used

9.1.1 Form of the Contract to be used shall be furnished by Facility Planning and Control, an example of which is bound in the Bid Documents.

9.2 Award

9.2.1 After award of the Contract, the successful Bidder, if a corporation, shall furnish to the Owner the most current copy of a Disclosure of Ownership Affidavit on file with the Secretary of State.

9.2.2 In accordance with Louisiana Law, when the Contract is awarded, the successful Bidder shall, at the time of the signing of the Contract, execute the Non-Collusion Affidavit included in the Contract Documents

9.2.3 When this project is financed either partially or entirely with State Bonds, the award of this Contract is contingent upon the sale of bonds by the State Bond Commission. The State shall incur no obligation to the Contractor until the Contract Between Owner and Contractor is duly executed.

ROOFING GUARANTEE R-1
(Roofing Contractor is Sub to G.C.)

OWNER: STATE OF LOUISIANA

ADDRESS: OFFICE OF FACILITY PLANNING AND CONTROL
POST OFFICE BOX 94095 CAPITOL STATION
BATON ROUGE, LOUISIANA 70804-9095

WHEREAS _____

Address _____

Telephone (____)_____ Email _____

herein called the "Roofing Contractor", has performed roofing and flashing in accordance with the Contract Documents for Project No. & WBS _____
_____ (hereinafter called the "Work") under a

Subcontract with _____

General Contractor on the Following Project: _____

Name of Project: _____

User Agency: _____

Location/Address: _____

Name and Type of Building(s): _____

_____ State I.D. _____

Type(s) of Roof Deck(s): _____

Total Roof Area: _____ SF; Flashing, Edge: _____ LF; Base: _____ LF

Date of Acceptance: _____ Guarantee Period: 2 Years

Date of Expiration: _____

AND WHEREAS the Roofing Contractor has contracted (as a Subcontractor) to guarantee said work against water entry from faulty or defective materials and workmanship for the designated Guarantee period;

AND WHEREAS the General Contractor, by its acceptance of the Contract for the above described project, has jointly assumed with the Roofing Contractor the obligations to the Owner of said guarantee against leaks and faulty or defective materials and workmanship;

NOW THEREFORE the Roofing Contractor and the General Contractor jointly and severally guarantee, subject to the terms and conditions herein set forth, that during the Guarantee Period they will at their own cost and expense, make or cause to be made with approved procedures and materials such repairs to or replacements of said work resulting from water entry or faults or defects of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in watertight conditions and further to respond on or within two (2) working days upon written notification of leaks or defects by the Owner/User Agency. Furthermore, they will at their own cost and expense maintain the roof for (2) years after acceptance, in accordance with the current edition of the Roof Maintenance Manual published by the Roofing Industry Educational Institute. The roof shall be inspected a minimum of twice each year, and a report prepared documenting the conditions observed at each inspection. These inspections shall be made once during the months of April or May and once during the months of September and October. Two copies of each report shall be forwarded to the Owner and User Agency.

This Guarantee is made subject to the following terms and conditions:

1. Specifically excluded from this guarantee are damages to the Work, other parts of the building and building contents caused by: A) lightning, and storm (includes hurricanes and tornadoes), hailstorm, earthquakes and other unusual phenomena of the elements; B) fire; and C) structural failures causing excessive roof deck, edgings and related roof components movement. When the Work has been damaged by any of the foregoing causes, the Guarantee will be null and void until such damage has been repaired by the Roofing Contractor, and until the cost and expense thereof has been paid by the Owner or another responsible party so designated.
2. During the Guarantee Period, if the Owner/User Agency allows alteration of the Work by anyone other than a Contractor approved in writing by the Roofing Subcontractor, General Contractor, and Roofing Material Manufacturer prior to the work being performed, including cutting, patching and maintenance in connection with penetrations, attachment of other work, and positioning of anything on the roof, this Guarantee shall become null and void upon the date of said alterations. If the Owner/User Agency engages the Roofing Contractor to perform said alterations, the Guarantee shall not become null and void, unless the Roofing Contractor, prior to proceeding with said work, shall have notified the Owner/User Agency in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the Work, thereby reasonably justifying a termination of this Guarantee.
3. During the Guarantee Period, if the original use of the roof is changed and it becomes used for, but for which it was not originally designed or specified, as a promenade, work deck, spray-cooled surface, flooded basin, or other use of service more severe than originally specified, this Guarantee shall become null and void upon the date of said change.
4. During the Guarantee Period, if any building or area of a building is changed to uses creating extremes of interior temperature and/or humidity, but for which it was not originally designed and specified, without provisions and alterations made to the building which effectively contain or control these conditions, this guarantee shall become null and void upon the date of said change.
5. The Owner/User Agency shall promptly notify the Roofing Contractor in writing of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the Roofing Contractor to inspect the Work, and to examine the evidence of such leaks, defects or deterioration.

6. This Guarantee is recognized to be the only guarantee of the General and Roofing Contractor on said work, and shall not operate to restrict or cut off the Owner from other remedies and recourses lawfully available to him in case of roofing failure. Specifically, this Guarantee shall not operate to relieve the Roofing Contractor of his responsibility for performance of the original work, regardless of whether the Contract was a Contract directly with the Owner or a Subcontract with the Owner's General Contractor.

IN WITNESS THEREOF, this instrument has been duly executed this _____
day of _____, 20____.

Roofing Contractor's Signature: _____

Typed Name: _____

Representing: _____

Telephone (____)_____, Email _____

Witness: _____

Witness: _____

And has been countersigned by the General Contractor issuing the Roofing Contractor's Subcontract for said work:

Name of General Contractor: _____

Date: _____ Authorized Signature: _____

Representing: _____

Typed Name: _____

Telephone (____)_____, Email _____

Witness: _____

Witness: _____

ROOFING GUARANTEE R-2
(Roofer is the Prime Contractor)

OWNER: STATE OF LOUISIANA

ADDRESS: OFFICE OF FACILITY PLANNING AND CONTROL
POST OFFICE BOX 94095 CAPITOL STATION
BATON ROUGE, LOUISIANA 70804-9095

WHEREAS _____

Address _____

Telephone (____)_____ Email _____

herein called the "Roofing Contractor", has performed roofing and flashing in accordance with the Contract Documents for Project No. & WBS _____
(hereinafter called the "Work") under a Contract with the Owner.

Name of Project: _____

User Agency: _____

Location/Address: _____

Name and Type of Building(s): _____

_____ State I.D. _____

Type(s) of Roof Deck(s): _____

Total Roof Area: _____ SF; Flashing, Edge: _____ LF; Base: _____ LF

Date of Acceptance: _____ Guarantee Period: 2 Years

Date of Expiration: _____

AND WHEREAS the Roofing Contractor has contracted to guarantee said work against water entry from faulty or defective materials and workmanship for the designated Guarantee period;

NOW THEREFORE the Roofing Contractor as the General Contractor guarantees, subject to the terms and conditions herein set forth, that during the Guarantee Period he will at his own cost and expense, make or cause to be made with approved procedures and materials such repairs to or replacements of said work resulting from water entry or faults or defects of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in watertight conditions and further to respond on or within

two (2) working days upon written notification of leaks or defects by the Owner/User Agency. Furthermore, he will at his own cost and expense maintain the roof for (2) years after acceptance, in accordance with the current edition of the Roof Maintenance Manual published by the Roofing Industry Educational Institute. The roof shall be inspected a minimum of twice each year, and a report prepared documenting the conditions observed at each inspection. These inspections shall be made once during the months of April or May and once during the months of September and October. Two copies of each report shall be forwarded to the Owner and User Agency.

This Guarantee is made subject to the following terms and conditions:

1. Specifically excluded from this guarantee are damages to the Work, other parts of the building and building contents caused by: A) lightning, windstorm (includes hurricanes and tornados), hailstorm, earthquakes and other unusual phenomena of the elements; B) fire; and C) structural failures causing excessive roof deck, edgings and related roof components movement. When the Work has been damaged by any of the foregoing causes, the Guarantee will be null and void until such damage has been repaired by the Roofing Contractor, and until the cost and expense thereof has been paid by the Owner or another responsible party so designated.
2. During the Guarantee Period, if the Owner/User Agency allows alteration of the Work by anyone other than a Contractor approved in writing by the Roofing Subcontractor, General Contractor, and Roofing Material Manufacturer prior to the work being performed, including cutting, patching and maintenance in connection with penetrations, attachment of other work, and positioning of anything on the roof, this Guarantee shall become null and void upon the date of said alterations. If the Owner/User Agency engages the Roofing Contractor to perform said alterations, the Guarantee shall not become null and void, unless the Roofing Contractor, prior to proceeding with said work, shall have notified the Owner/User Agency in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the Work, thereby reasonably justifying a termination of this Guarantee.
3. During the Guarantee Period, if the original use of the roof is changed and it becomes used for, but for which it was not originally designed or specified, as a promenade, work deck, spray-cooled surface, flooded basin, or other use of service more severe than originally specified, this Guarantee shall become null and void upon the date of said change.
4. During the Guarantee Period, if any building or area of a building is changed to uses creating extremes of interior temperature and/or humidity, but for which it was not originally designed and specified, without provisions and alterations made to the building which effectively contain or control these conditions, this Guarantee shall become null and void upon the date of said change.
5. The Owner/User Agency shall promptly notify the Roofing Contractor in writing of observed, known or suspected leaks, defects or deterioration and shall afford reasonable opportunity for the Roofing Contractor to inspect the Work, and to examine the evidence of such leaks, defects or deterioration.
6. This Guarantee is recognized to be the only guarantee of the General and Roofing Contractor on said work, and shall not operate to restrict or cut off the Owner from other remedies and recourses lawfully available to him in case of roofing failure. Specifically, this Guarantee shall not operate to relieve the Roofing Contractor of his responsibility for performance of the original work, regardless of whether the Contract was a Contract directly with the Owner or a Subcontract with the Owner's General Contractor.

IN WITNESS THEREOF, this instrument has been duly executed this _____
day of _____, 20_____.

Roofing Contractor's Signature: _____

Typed Name: _____

Representing: _____

Telephone (____)_____ Email _____

Witness: _____

Witness: _____

MANUFACTURER'S NDL WATERTIGHTNESS MEMBRANE ROOFING SYSTEM WARRANTY

ISSUE TO:

STATE OF LOUISIANA- DOA- FACILITY PLANNING AND CONTROL

MFGR WARRANTY NUMBER: _____

_____, hereinafter referred to as “mfgr” hereby warrants to the owner, known as the State of Louisiana, hereinafter referred to as the “State” that the referenced membrane roofing assembly will remain in a watertight condition for a period of _____ years. For the purpose of this warranty “watertight” or “watertightness means that the roofing system does not allow water to leak through a breach in the roofing system. Mfgr further warrants the performance of the products listed below and warrants that the material and installation of the roofing assembly is free of material and known installation defects at the time of application and that the materials listed below conform to mfgr specifications.

All products used in the roofing assembly from the deck (structural concrete, metal, LWIC, wood, etc.), up are included in this warranty regardless of whether mfgr furnished or branded the products with the exception of shop fabricated metals not furnished by mfgr. These products are to include, but not be limited to: base sheets, fasteners and plates, insulation board, cover board, asphalt, adhesives (insulation and membrane), mastics, field plies, membrane flashing plies and liquid flashing products. The roofing products are specifically listed as follows:

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

In the event that the new membrane roofing assembly is installed in a recover fashion over an existing roofing assembly, the performance of the existing roofing products that remain in-place beneath the new roofing assembly are excluded from this warranty.

In the event that covered leaks occur in the roofing system that are attributable to the workmanship of the installing contractor or a defect in or failure of any of the mfgr products listed above, mfgr will make repairs required to return the roof to a watertight condition, regardless of the scope and cost of the required repairs. The State will notify mfgr within 30 days of the discovery of the leak. Should the State not make this notification within the prescribed 30 day time period, then further damage to the roofing assembly caused by the delay in notification will not be construed as a warranty repair item. Mfgr will respond to the leak notification within 10 days and once it is confirmed that the leak(s) is within the scope of mfgrs responsibilities under this warranty, mfgr will execute repairs promptly thereafter. Mfgr's failure to respond timely and make proper repairs shall enable the State to engage service of "others" to address the problem(s) at mfgr's expense assuming the cost of the repair is reasonable and the scope of the repair is limited to the remedy of the leak without jeopardizing State's protection under terms of this warranty. The State may make reasonable and customary emergency temporary repairs at its discretion and at mfgrs expense without jeopardizing the State's protection under the terms of this warranty.

The manufacturers of SBS products that are approved by the State and included in the State's list of acceptable products have agreed to a dimensional stability of the cap sheet and interply sheet of 0.2% per ASTM D 5147, section 10. 0.2% of a 33 foot roll is approximately equal to $\frac{3}{4}$ ". For the term of this warranty, SBS cap sheet shrinkage in excess of $\frac{3}{4}$ " will be repaired by the mfgr by cutting out the interply void in the "T" lap, cleaning and drying, and repair with an acceptable cap sheet product.

The following items are excluded from this warranty:

1. Damage to the roof caused by wind exceeding 72 mph, lightning, hail, fire or physical damage from falling or wind-blown objects
2. Deficient design by other than mfgr
3. Intentional or accidental damages to the roof, or misuse, abuse, vandalism or the likes
4. Leaks caused by deterioration or failure of items not included in the warranty
5. Modifications or alterations to the roofing assembly after completion unless done in a manner approved by mfgr
6. Damage to the roofing assembly after issuance of this warranty caused by excessive foot traffic or its use as a work platform or storage area
7. Damage to the roofing assembly caused by ponding water, which is defined as water on the surface of the roof that does not dissipate within 72 hours of average drying conditions
8. Consequential and incidental damages, including damage to the building or its contents
9. Damage to the roofing assembly caused by failure by the State to exercise reasonable care and maintenance

10. Damage to the roofing assembly caused by structural defects or failure or excessive movement of building components
11. Damage to the roofing assembly due to exposure to chemical attack, including deposits of animal fats, grease and oil
12. The State shall be responsible for the costs associated with the removal and replacement of any overburden, superstrata or overlays, either permanent or temporary, which include but are not limited to: structures or assemblies added after installation, fixtures or utilities on or through the roofing assembly, support platforms or bases for solar panels, garden roofs, decks, patios or any other obstacles that impede access, clear observation, investigation or repairs to the roofing system, excluding ballast or pavers or any other overburden specifically accepted by mfrg to be included within warranty coverage.

For wind related events, this warranty excludes damage to the roofing assembly where the cause includes any of the following:

- A. Failure or excessive movement of primary or secondary structural elements or roof deck, wood nailers or blocking and edge system components not furnished by mfrg
- B. Failure of walls, doors, windows, openings or other building envelope components
- C. Rooftop structures and equipment

Mfrg may have access to the roof for inspection purposes for the term of the warranty by scheduling through the appropriate State Agency.

This warranty is tendered for the benefit of the State and is not transferable or assignable without the written consent of Mfrg.

The Nineteenth Judicial District Court in and for the Parish of East Baton Rouge, State of Louisiana shall have sole jurisdiction in any action brought as a result of this warranty by any party hereto. This warranty shall be governed by and construed in accordance with the laws of the State of Louisiana.

This warranty instrument supersedes and is in lieu of any and all other expressed or implied warranties that are or may be in conflict with terms and conditions stated herein.

This warranty requires the signature of an authorized officer of Mfrg. Three fully executed copies are to be provided to the State as a prerequisite for project acceptance. The State's signature shall not be a requirement for implementation of, or cause to validate this warranty.

A separate and independent warranty shall be issued for each building or independent roof system in the case of multiple buildings or mixed roof types.

Abbreviations: LWIC—

Lightweight Insulating Concrete

ASTM—American Society for Testing and Materials

PROJECT DATA / SIGNATURE

Owner: State of Louisiana- DOA- Facility Planning and Control

Building/Project Name: _____

Roof Type: _____

No. of Squares: _____

Location: _____

La. State Building I.D.: _____

Site Code: _____

LA State Project Number: _____

Date of Project Acceptance and Commencement of Warranty: _____

Warranty End Date: _____

Manufacturer Name Address and Phone Number:

Authorized Manufacturer Signature: _____

Printed name

_____/_____/_____
Date

Title

Direct to:

STATE of LOUISIANA (Owner)

DIVISION OF ADMINISTRATION

Facility Planning and Control

PO Box 94095

Baton Rouge, Louisiana 70804-9095

////////// END NDL WATERTIGHTNESS WARRANTY \\\\\\\\\\\\\\\\\\\



Johns Manville

075423-A: Existing Roof Warranty For Reference Only

ULM - School of Construction

Peak Advantage Guarantee



Building Owner:

University of Louisiana Monroe
700 University Avenue
Monroe, LA 71209

Guarantee Number: ANT148008694

Expiration Date: January 15, 2039

Job Name: ULM Construction Building

Date of Completion: January 15, 2019

Building Name:

ULM Construction Building
700 University Avenue
Monroe, LA 71209

Approved Roofing Contractor:

LOUISIANA ROOFING CONTRACTORS LLC
3200 SHED ROAD
BOSSIER CITY, LA 71111

Terms & Maximum Monetary Obligation to Maintain a Watertight Roofing System.

Years: 20 Year

\$ No Dollar Limit

Coverage:

The components of the Roofing System covered by this Guarantee are:

Total Squares: 214

Sec.	Sqs.	Roof Type	Membrane Spec.	Insulation Type			Cover Board
				Layer 1	Layer 2	Layer 3	
1	214	TPO	ST6PU	Tapered ENRGY 3	ENRGY 3		

Accessories:	Type	Product Name	Quantity
	Expand-O-Flash (1) Style:		lin. ft.
	Expand-O-Flash (2) Style:		lin. ft.
	Expand-O-Flash (3) Style:		lin. ft.
	Fascia Style:		lin. ft.
	Copings Style:		lin. ft.
	Drains (1) Style:		ea.
	Vents Style:		ea.

These Johns Manville Guaranteed components are referred to above as the "Roofing System" and ALL OTHER COMPONENTS OF THE OWNER'S BUILDING ARE EXCLUDED FROM THE TERMS OF THIS GUARANTEE, including any amendments thereto.

Johns Manville* guarantees to the original Building Owner that during the Term commencing with the Date of Completion (as defined above), JM will pay for the materials and labor reasonably required in Johns Manville's sole and absolute discretion to repair the Roofing System to return it to a watertight condition if leaks occur due to: ordinary wear and tear, or deficiencies in any or all of the Johns Manville component materials of the Roofing System, or workmanship deficiencies only to the extent they arise solely out of the application of the Roofing System. Non-leaking blisters are specifically excluded from coverage. Should any investigation or inspection reveal the cause of a reported leak to be outside the scope of coverage under this Guarantee, then all such investigation and inspection costs shall be borne solely by the Building Owner.

WHAT TO DO IF YOUR ROOF LEAKS

If you should have a roof leak please refer to directions on the reverse side. Failure by the Building Owner to comply with any of the directions on the reverse side of this document will render the coverage provided under this Guarantee, including any applicable amendments and/or riders, null and void.

LIMITATIONS AND EXCLUSIONS

This Guarantee is not a maintenance agreement or an insurance policy; therefore, routine inspections and maintenance are the Building Owner's sole responsibility (see reverse side of this document). Failure to follow the Maintenance Program on the reverse side of this document will void the Guarantee in its entirety. This Guarantee does not obligate JM to repair or replace the Roofing System, or any part of the Roofing System, for leaks or appearance issues resulting, in whole or in part, from one or more of the following (a) natural disasters including but not limited to the direct or indirect effect of lightning, flood, hail storm, earthquake, tornados, hurricanes or other extraordinary natural occurrences and/or wind speeds in excess of 55 miles per hour; (b) misuse, abuse, neglect or negligence; (c) installation or material failures other than those involving the component materials expressly defined above as the Roofing System or exposure of the Roofing System components to damaging substances such as oil, fertilizers, or solvents or to damaging conditions such as vermin; (d) any and all (i) changes, alterations, repairs to the Roofing System, including, but not limited to, structures, penetrations, fixtures or utilities (including vegetative and solar overlays) based upon or through the Roofing System as well as any (ii) changes to the Building's usage that are not pre-approved in writing by JM; (e) failure of the Building substrate (mechanical, structural, or otherwise and whether resulting from Building movement, design defects or other causes) or improper drainage; (f) defects in or faulty/improper design, specification construction or engineering of the Building or any area over which the Roofing System is installed; (g) defects in or faulty/improper architectural, engineering or design flaws of the Roofing System or Building, including, but not limited to, design issues arising out of improper climate or building code compliance; or (h) in instances of a recover project, Johns Manville is not responsible for the performance of pre-existing materials that predated the recover. Instead, Johns Manville's sole responsibility in recover systems where JM materials are adhered to existing materials is limited to the installed recover JM Roofing materials up to the wind speed listed herein. Guarantee coverage is limited to replacing recover JM Roofing materials only (and not the pre-existing materials – which is the Owner's responsibility) as required to return the roofing system to a watertight condition due to a claim covered under the terms and conditions herein. Johns Manville is not responsible for leaks, injuries or damages resulting from any water entry from any portion of the Building structure not a part of the Roofing System, including, but not limited to, deterioration of the roofing substrate, walls, mortar joints, HVAC units and all other non-Johns Manville materials and metal components. Moreover, the Building Owner is solely and absolutely responsible for any removal and/or replacement of any overburdens, super-strata or overlays, in any form whatsoever, as reasonably necessary to expose the Roofing System for inspection and/or repair.

This Guarantee becomes effective when (1) it is delivered to Owner; and (2) all bills for installation, materials, and services have been paid in full to the Approved Roofing contractor and to JM. Until that time, this Guarantee is not in force, has no effect – and JM is under no obligation whatsoever to perform any services/work.

The Parties agree that any controversy or claims relating to this Guarantee shall be first submitted to mediation under the Construction Industry Arbitration and Mediation Rules of the American Arbitration Association (Regular Track Procedures) or to such other mediation arrangement as the parties mutually agree. No court or other tribunal shall have jurisdiction until the mediation is completed. In any action or proceeding brought against the Building Owner to enforce this Guarantee or to collect costs due hereunder, Johns Manville shall be entitled to recover its reasonable costs, expenses and fees (including expert witness' fees) incurred in any such action or proceeding, including, without limitation, attorneys' fees and expenses, and the Building Owner shall pay it.

TO THE FULLEST EXTENT PERMITTED BY LAW, JM DISCLAIMS ANY IMPLIED WARRANTY, INCLUDING THE WARRANTY OF MERCHANTABILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, AND LIMITS SUCH WARRANTY TO THE DURATION AND TO THE EXTENT OF THE EXPRESS WARRANTY CONTAINED IN THIS GUARANTEE.

THE EXCLUSIVE RESPONSIBILITY AND LIABILITY OF JM UNDER THIS GUARANTEE IS TO MAKE REPAIRS NECESSARY TO MAINTAIN THE ROOFING SYSTEM IN A WATERTIGHT CONDITION IN ACCORDANCE WITH THE OBLIGATIONS OF JM UNDER THIS GUARANTEE. JM AND ITS AFFILIATES WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES TO THE BUILDING STRUCTURE (UPON WHICH THE ROOFING SYSTEM IS AFFIXED) OR ITS CONTENTS AND OR OCCUPANTS, LOSS OF TIME OR PROFITS OR ANY INCONVENIENCE, INJURY. JM SHALL NOT BE LIABLE FOR ANY CLAIM MADE AGAINST THE BUILDING OWNER BY ANY THIRD PARTY AND THE BUILDING OWNER SHALL INDEMNIFY AND DEFEND JM AGAINST ANY CLAIM BROUGHT BY ANY THIRD PARTY AGAINST JM RELATING TO OR ARISING OUT OF THE ROOFING SYSTEM OR JM'S OBLIGATIONS UNDER THIS GUARANTEE. JM AND ITS AFFILIATES SHALL NOT BE LIABLE FOR ANY DAMAGES WHICH ARE BASED UPON NEGLIGENCE, BREACH OF WARRANTY, STRICT LIABILITY OR ANY OTHER THEORY OF LIABILITY OTHER THAN THE EXCLUSIVE LIABILITY SET FORTH IN THIS GUARANTEE. THIS GUARANTEE DOES NOT COVER, AND EXPLICITLY EXCLUDES, ANY AND ALL INJURIES, CLAIMS AND/OR DAMAGES RESULTING, IN WHOLE OR IN PART, FROM ANY WATER ENTRY FROM ANY PORTION OF THE BUILDING STRUCTURE INCLUDING, BUT NOT LIMITED TO, THE ROOFING SYSTEM.

No one is authorized to change, alter, or modify the provision of this Guarantee other than the Manager, Guarantee Services or authorized delegate. JM's delay or failure in enforcing the terms and conditions contained in this Guarantee shall not operate as a waiver of such terms and conditions. This Guarantee is solely for the benefit of the Building Owner identified above and Building Owner's rights hereunder are not assignable. Upon sale or other transfer of the Building, Building Owner may request transfer of this Guarantee to the new owner, and JM may transfer this Guarantee, in its sole and absolute discretion only after receiving satisfactory information and payment of a transfer fee, which must be paid no later than 30 days after the date of Building ownership transfer.

In the event JM pays for repairs which are required due to the acts or omissions of others, JM shall be subrogated to all rights of recovery of the Building Owner to the extent of the amount of the repairs.

Because JM does not practice Engineering or Architecture, neither the issuance of this Guarantee nor any review of the Building's construction or inspection of roof plans (or the Building's roof deck) by JM representatives shall constitute any warranty by JM of such plans, specifications, and construction or in any way constitute an extension of the terms and conditions of this Guarantee. Any roof inspections are solely for the benefit of JM.

JM does not supervise nor is it responsible for a roofing contractor's work except to the extent stated herein, and roofing contractors are not agents of JM.

*JOHNS MANVILLE ("JM") is a Delaware corporation with its principal mailing address at P.O. Box 5108, Denver, Colorado 80217-5108.



By: Joseph Smith
Title: President Roofing Systems

Addendum(s)

~ None ~

Maintenance Program

In order to continue the coverage of this Guarantee, the following Maintenance Program must be implemented and followed:

1. Building Owner must notify JM Guarantee Services Unit (see below) immediately upon discovery of the leak and in no event later than ten (10) days after initial discovery of the leak, time being of the essence. Failure of the Building Owner to provide timely notice to JM Guarantee Services of any leak is a material ground for termination of the Guarantee.
2. In response to timely notice, JM will arrange to inspect the Roofing System, and
 - (i) If, in JM's sole and absolute opinion, the leak(s) is/are the responsibility of JM under this Guarantee (see Limitations and Exclusions), then JM will take prompt appropriate action to return the Roofing system to a watertight condition, or
 - (ii) If, in JM's sole and absolute opinion, the leak(s) is/are not the responsibility of JM under this Guarantee, then JM will advise the Building Owner within a reasonable time of the minimum repairs that JM believes are required to return the Roofing System to a watertight condition. If the Building Owner, at his expense, promptly and timely makes such repairs to the Roofing System (time being of the essence) then this Guarantee will remain in effect for the unexpired portion of its Term. Failure to make any of these repairs in a timely and reasonable fashion will void any further obligation of JM under this Guarantee as to the damaged portion of the Roofing System as well as any other areas of the Roofing System impacted by such failure.
3. In the event an emergency condition exists which requires immediate repair to avoid damage to the Building, its contents or occupants, then Building Owner may make reasonable, essential temporary repairs. JM will reimburse Building Owner for those reasonable repair expenses only to the extent such expenses would have been the responsibility of JM under the Guarantee.

There are a number of items not covered by this Guarantee that are the sole, exclusive responsibility of the Building Owner. In order to ensure that your new roof will continue to perform its function and to continue JM's obligations under the Guarantee, you must examine and maintain these items on a regular basis:

- Maintain a file for your records on this Roofing System, including, but not limited to, this Guarantee, invoices, and subsequent logs of all inspections performed and repairs that are made to the Roofing System.
- Inspect your Roofing System at least semi-annually. This is best done in the spring, after the Roofing System has been exposed to the harsh winter conditions, and, in the Fall after a long hot summer. It is also a good idea to examine the Roofing System for damage after severe weather conditions such as hailstorms, heavy rains, high winds, etc.
- Since these types of Roofing Systems typically have a low slope, they are easily examined. However, care must be taken to prevent falling and other accidents. JM expressly disclaims and assumes no liability for any inspections performed on the Roofing System.

When checking the Roofing System:

- Remove any debris such as leaves, small branches, dirt, rocks, etc. that have accumulated.
- Clean gutters, down spouts, drains and the surrounding areas. Make certain they allow water to flow off the Roofing System. Positive drainage is essential.
- Examine all metal flashings and valleys for rust and damage that may have been caused by wind or traffic on the Roofing System, and make certain they are well attached and sealed. Any damaged, loose, or poorly sealed materials must be repaired by a JM Approved Roofing Contractor only.
- Examine the areas that abut the Roofing System. Damaged masonry, poorly mounted counter flashing, loose caulking, bad mortar joints, and any loose stone or tile coping can appear to be a membrane leak. Have these items repaired by a JM Approved Roofing Contractor if found to be defective.
- Examine the edges of the Roofing System. Wind damage often occurs in these areas. Materials that have been lifted by the wind need to be corrected by a JM Approved Roofing Contractor.
- Examine any roof top equipment such as air conditioners, evaporative coolers, antennas, etc. Make certain they do not move excessively or cause a roof problem by leaking materials onto the Roofing System.
- Check the building exterior for settlement or movement. Structural movement can cause cracks and other problems which in turn may lead to leaks in your Roofing System.
- Examine protective coatings; any cracked, flaking, or blistered areas must be recoated.

Protecting your investment:

- Avoid unnecessary roof top traffic.
- If you allow equipment servicemen to go onto the Roofing System, advise them to be careful. Dropped tools, heavy equipment, etc. can damage the membrane. Log all such trips to the Roofing System.
- Do not allow service personnel to make penetrations into the Roofing System; these are to be made only by a JM Approved Roofing Contractor.

All the terms and conditions of this Guarantee shall be construed under the internal law of the state of Colorado without regard to its conflicts of law principles. Invalidity or unenforceability of any provisions herein shall not affect the validity or enforceability of any other provision which shall remain in full force and effect to the extent the main intent of the document is preserved.

This form is not to be copied or reproduced in any manner. This Guarantee is valid only in the United States of America.

Guarantee Services
(800) 922-5922
E-mail: gsu@jm.com
www.jm.com/roofing

Mailing Address:
Johns Manville
Guarantee Services
P.O. Box 625001
Littleton, CO 80162-5001

Shipping Address:
Johns Manville
Guarantee Services
10100 West Ute Avenue
Littleton, CO 80127

Facility Planning & Control
CHANGE ORDER

PROJECT NAME: _____ CHANGE ORDER No. _____
PROJECT & WBS No: _____ CONTRACT DATE: _____
CONTRACTOR: _____ NTP DATE: _____
SITE CODE: _____ STATE ID: _____ SRM No.: _____

You are directed to make the following change(s) in this contract. Attach SUMMARY, BREAKDOWN and/or UNIT PRICE BREAKDOWN forms as required and give a brief description of each change below, including RFI No., cost and days from Summary

The Original Contract Sum _____
Total Changes by Previous Change Order(s) _____
Current Contract Sum _____
Contract Sum will be ☐ unchanged ☐ increased by ☐ decreased by: _____
New Contract Sum _____
The Original Contract Completion Date and Contract Time. Date: _____ DAYS
Total Time extended by Previous Change Order(s) _____ DAYS
Contract Time will be ☐ unchanged ☐ increased by ☐ decreased by: _____ DAYS
New Contract Completion Date & Contract Time Date: _____ DAYS
Added Building Area _____ (Sq. Ft.)

NOTE: No additional increase in time or money will be considered for a Change Order item after it has been executed.

RECOMMENDED **ACCEPTED** **APPROVED**
Designer's Name: _____ Contractor's Name: _____ Project Manager: _____

Address: _____ Address: _____ Facility Planning & Control

Email Address: _____ Email Address: _____

By: _____ By: _____ By: _____

Date: _____ Date: _____ Date: _____

FACILITY PLANNING AND CONTROL USE ONLY

Classification	Amount	Classification	Amount
Omission (Type "O")*	_____	Miscellaneous (Type "M")	_____
Error (Type "E")*	_____	Owner Requested (Type "R")	_____
COMMENTS:	Senior Manager/Assistant Director approval: _____		

Facility Planning & Control
LIQUIDATED DAMAGES ASSESSMENT

TO: FACILITY PLANNING & CONTROL
P.O. Box 94095
Baton Rouge, LA 70804-9095

FROM: _____

Design Firm Name and Address

DATE: _____

PROJECT NAME: _____

PROJECT No: _____ WBS No: _____

SITE CODE: _____ STATE ID: _____ CFMS / SRM #: _____

CONTRACTOR: _____

ORIGINAL CONTRACT AMOUNT: \$ _____

FINAL CONTRACT AMOUNT: \$ _____

DATE OF ACCEPTANCE: _____

CONTRACT DATE OF COMPLETION: _____

NUMBER OF DAYS OVERRUN (As of Acceptance Date) _____

LIQUIDATED DAMAGES PER DAY STIPULATED IN CONTRACT \$ _____

LIQUIDATED DAMAGES ASSESSMENT \$ _____

Signed: _____
DESIGNER

Signed: _____
PROJECT MANAGER

c: User Agency

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. Access to site.
5. Work restrictions.
6. Specification and drawing conventions.
7. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: STATE PROJECT NO. 19-629-23-01, F.19002614

B. Project Location: U.L.M. - 507 FILHIOL AVE. MONROE, LOUISIANA 71203

C. Owner: Facility Planning and Control

D. Architect: TBA Studio Architects

E. Project Web Site: A project Web site administered by Architect will be used for purposes of managing communication and documents during the construction stage.

1. See Section 013100 "Project Management and Coordination." for requirements for using Project Web site.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of this Project is defined by the Contract Documents and consists of the following:
The project consists of an addition to practice construction and meeting rooms additional information can be viewed on the drawings.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.5 ACCESS TO SITE

- A. Pre-Bid Access: The buildings will be available for field verification on the day of the pre-bid unless other arrangements are made with the owner/Principal. Parties seeking access to the buildings shall notify Architect, through Prime Bidders, to coordinate scheduling of access. Failure to provide said notification shall not be cause for claim of inability to perform pre-bid field verification, nor shall failure of party(s) to make themselves available, during the time period the buildings are available.
- B. General: 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. See Notes above for additional information.
- C. 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: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet beyond building perimeter; 10 feet beyond surface walkways, patios, surface parking, and utilities less than 12 inches in diameter; 15 feet beyond primary roadway curbs and main utility branch trenches; and 25 feet beyond constructed areas with permeable surfaces (such as pervious paving areas, storm-water detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
 - 2. Driveways, Walkways and Entrances: Keep driveways, loading areas and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- D. 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.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than 3 business days in advance of proposed utility interruptions.
 - 2. Obtain Architect's written permission before proceeding with utility interruptions.
- C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Architect not less than two business days in advance of proposed disruptive operations.
 - 2. Obtain Architect's written permission before proceeding with disruptive operations.
- D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.7 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. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. 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 published as part of the U.S. National CAD Standard and scheduled on Drawings.
 - 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

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES, NFPA & ADA.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within (15) fifteen days of receipt of request, or (7) seven days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, 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.

1.4 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.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than (15) fifteen 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:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution will not adversely affect Contractor's construction schedule.

- c. Requested substitution has received necessary approvals of authorities having jurisdiction.
- d. Requested substitution is compatible with other portions of the Work.
- e. Requested substitution has been coordinated with other portions of the Work.
- f. Requested substitution provides specified warranty.
- g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 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 the "Architect's Supplemental Instructions" form included in Project Manual.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect or Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect or Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 10 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor 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 Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect or Construction Manager.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 (form included in Project Manual).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. 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 (7) days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Sub-schedules for Phased Work: Where the Work is separated into phases, requiring separately phased payments, provide sub-schedules showing values, coordinated with each phase of payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Owner – Facility Planning and Control, Baton Rouge, Louisiana 70804
 - b. Architect - TBA Studio, West Monroe, Louisiana 71291
 - c. Architect's project number 24-WM0059
 - d. Contractor's name and address.
 - e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703. Retain option in first subparagraph below where Contractor's ongoing activities related to Project closeout will be a line item subject to Application for Payment approval.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five (5) percent of the Contract Sum.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the 30th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect 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 of Change Orders issued, before last day of construction period covered by application.
- F. Transmittal: Submit five (5) signed and notarized original copies of each Application for Payment to Architect. 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. 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. Schedule of unit prices.
 5. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
 12. Certificates of insurance and insurance policies.
- 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.
 2. This application shall reflect Certificates of Partial 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. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707-1994, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. 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.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination drawings.
 - 2. Requests for Information (RFIs).
 - 3. Project Web site.
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

- A. RFI: Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 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, and telephone number 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.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components 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 activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown 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. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- 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.

2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
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. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect and Construction Manager
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716 acceptable to Architect.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven (7) working days for

Architect's response for each RFI. RFIs received by the Construction Manager, after 1:00 p.m., will be considered as received the following working day.

1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or 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 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 the Construction Manager in writing within (10) ten 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 weekly. Include the following:
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 dropped and not submitted.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's and Construction Manager's response was received.
- 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 (7) days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct, 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.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three (3) days of the meeting.
- B. Preconstruction Conference: Architect or 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. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of record documents.
 - l. Use of the premises[and existing building].
 - m. Work restrictions.
 - n. Working hours.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Parking availability.
 - t. Office, work, and storage areas.
 - u. Equipment deliveries and priorities.
 - v. First aid.
 - w. Security.
 - x. 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 that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager, and Owner 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 problems.
 - 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.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at monthly intervals.
1. 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.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

- a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
3. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.
- B. Related Requirements:

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Float: The measure of leeway in starting and completing an activity.
 - 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].

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
 - 3. Two paper copies.

- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Daily Construction Reports: Submit at monthly intervals.
- F. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 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.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established from the "Notice to Proceed" to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - a. <Insert list of major items or pieces of equipment>.
 3. Submittal Review Time: Include review and re-submittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 3. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 4. Work Stages: Indicate important stages of construction for each major portion of the Work.
 5. Other Constraints:
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following milestone:
1. <Insert milestones not indicated elsewhere>.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.

5. Pending modifications affecting the Work and Contract Time.

- F. 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 compliance with the schedule.
- G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer for completion indicate an estimated completion percentage in ten (10) percent increments within time bar.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a[cost- and resource-loaded,] time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for [the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Sub-networks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.

2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events.
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week, before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.

- B. Distribution: Distribute copies of approved schedule to Architect or 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.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.2 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph or video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Construction Photographs: Submit unaltered, original, full-size image files within three days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name of Architect and Construction Manager.
 - c. Name of Contractor.
 - d. Date photograph was taken if not date stamped by camera.
 - e. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - f. Unique sequential identifier keyed to accompanying key plan.

1.3 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from contractor to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, with minimum size of 8 megapixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Construction Manager.
- C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Construction Manager.
 - 1. Flag excavation areas, construction limits before taking construction photographs.
 - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
- D. Periodic Construction Photographs: Take 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as Project Record Documents. Architect or Construction Manager will inform contractor of desired vantage points.
- F. Additional Photographs: Architect or Construction Manager may request photographs in addition to periodic photographs specified. Additional photographs shall be included in the Contract Sum.
 - 1. Three days' notice will be given, where feasible.
 - 2. In emergency situations, take additional photographs within 24 hours of request.
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:

- a. Special events planned at Project site.
- b. Immediate follow-up when on-site events result in construction damage or losses.
- c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
- d. Substantial Completion of a major phase or component of the Work.
- e. Extra record photographs at time of final acceptance.
- f. Owner's request for special publicity photographs.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
 - 1. Submittals for Special Systems, required by the Authority(s) Having Jurisdiction, are not exempt, from the requirements of this Section.
- B. All documents transmitted for the purpose of administration among team members shall be through the project management software **PROCORE (www.procore.com)** The Contractors use of this software shall be discussed at the pre-construction meeting.
- C. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents, supplementary instructions, change proposals, change orders, applications for payment, field reports and meeting minutes, and any other document any participant wishes to make part of the project record.
- D. Contractor and Architect is required to use this service.
- E. It is the contractors responsibility to submit documents in PDF format. All documents submitted to the architect shall first be review by the contractor and shall carry the contractors approval stamp indicating compliance with the Contract Documents.
- F. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat).
- G. PAPER document transmittals **will not** be reviewed; emailed PDF documents **will not** be reviewed. Provide paper submittals when required to submit fire alarm or sprinkler shop drawings that will be submitted to the Fire Marshal.
- H. All other submittal and document transmission procedures apply, except that electronic document requirement will not apply to samples or color selection charts.
- I. The service will be at no cost.
- J. Submittal Service: The selected service is PROCORE - (866) 477-6267, www.procore.com.
- K. Training one, one hour web-based training session will be arranged for all participants, with representatives of TBA Studio and contractor participating, further training is the responsibility of the user of the service.
- L. Project Closeout: TBA Studio will determine when to terminate the service for the project and is responsible for obtaining archive copies of the files..

M. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action.
- 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.

1.3 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule 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.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals as noted below.
 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
- B. Electronic Submittals: Identify and incorporate information in each electronic submittal file 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.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
 4. Transmittal Form for Electronic Submittals: Use software-generated form from PROCORE (www.procore.com), containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- C. Options: Identify options requiring selection by Architect.
- D. Deviations: Identify deviations from the Contract Documents on submittals.
- E. 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.
- F. 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.

- G. 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' action stamp.
- H.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Send electronic submittals as PDF electronic files directly to Architect and /or Construction Manager specifically established for Project.
 - a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Submit electronic submittals via email as PDF electronic files.
 - a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect, through Construction Manager, will return two copies.
4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect and Construction Manager will not return copies.
5. Certificates and Certifications Submittals: Provide 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.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.

- e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
- 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 5. Submit Product Data before or concurrent with Samples.
- 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. 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, unless submittal based on Architect's digital data drawing files is otherwise permitted.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 24 by 36 inches (914 by 607).
 - 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 - b. Three opaque copies of each submittal. Architect and Construction Manager will retain one copy; remainder will be returned.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.

- b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set 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 three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three number sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Submit product schedule in the following format:
 - a. PDF electronic file.
 - b. Three paper copies of product schedule or list unless otherwise indicated. Architect, through Construction Manager, will return two copies.

- F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. 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.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. 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.
- O. 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.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. 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.
- S. 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.

- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- U. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."
- V. 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.
- W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- X. 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.
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections

and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

- A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect or Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. 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.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
 - 3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- D. 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.

- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" 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.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.

2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and re-inspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

- d. When testing is complete, remove test specimens, assemblies, mockups and laboratory mockups; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
 2. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.

- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:
- B. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying 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 of 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 re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in 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

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.
- 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.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
10. AF&PA - American Forest & Paper Association; www.afandpa.org.
11. AGA - American Gas Association; www.aga.org.
12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
14. AI - Asphalt Institute; www.asphaltinstitute.org.
15. AIA - American Institute of Architects (The); www.aia.org.
16. AISC - American Institute of Steel Construction; www.aisc.org.
17. AISI - American Iron and Steel Institute; www.steel.org.
18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
20. ANSI - American National Standards Institute; www.ansi.org.
21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
22. APA - APA - The Engineered Wood Association; www.apawood.org.
23. APA - Architectural Precast Association; www.archprecast.org.
24. API - American Petroleum Institute; www.api.org.
25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
26. ARI - American Refrigeration Institute; (See AHRI).
27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
28. ASCE - American Society of Civil Engineers; www.asce.org.
29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.

38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWWA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
47. BOCA - BOCA; (Building Officials and Code Administrators International Inc.); (See ICC).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; www.ec-central.org.
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECA).
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
80. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.

81. FM Approvals - FM Approvals LLC; www.fmglobal.com.
82. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarooft.com.
84. FSA - Fluid Sealing Association; www.fluidsealing.com.
85. FSC - Forest Stewardship Council U.S.; www.fscus.org.
86. GA - Gypsum Association; www.gypsum.org.
87. GANA - Glass Association of North America; www.glasswebsite.com.
88. GS - Green Seal; www.greenseal.org.
89. HI - Hydraulic Institute; www.pumps.org.
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
93. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
94. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
95. IAS - International Approval Services; (See CSA).
96. ICBO - International Conference of Building Officials; (See ICC).
97. ICC - International Code Council; www.iccsafe.org.
98. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
99. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
100. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
101. IEC - International Electrotechnical Commission; www.iec.ch.
102. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
103. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
104. IESNA - Illuminating Engineering Society of North America; (See IES).
105. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
106. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
107. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
108. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
109. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
110. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
111. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
112. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
113. ISO - International Organization for Standardization; www.iso.org.
114. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
115. ITU - International Telecommunication Union; www.itu.int/home.
116. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
117. LMA - Laminating Materials Association; (See CPA).
118. LPI - Lightning Protection Institute; www.lightning.org.
119. MBMA - Metal Building Manufacturers Association; www.mbma.com.
120. MCA - Metal Construction Association; www.metalconstruction.org.
121. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
122. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
123. MHIA - Material Handling Industry of America; www.mhia.org.
124. MIA - Marble Institute of America; www.marble-institute.com.

125. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
126. MPI - Master Painters Institute; www.paintinfo.com.
127. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
128. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
129. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
130. NADCA - National Air Duct Cleaners Association; www.nadca.com.
131. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
132. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
133. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
134. NCMA - National Concrete Masonry Association; www.ncma.org.
135. NEBB - National Environmental Balancing Bureau; www.nebb.org.
136. NECA - National Electrical Contractors Association; www.necanet.org.
137. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
138. NEMA - National Electrical Manufacturers Association; www.nema.org.
139. NETA - InterNational Electrical Testing Association; www.netaworld.org.
140. NFHS - National Federation of State High School Associations; www.nfhs.org.
141. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
142. NFPA - NFPA International; (See NFPA).
143. NFRC - National Fenestration Rating Council; www.nfrc.org.
144. NHLA - National Hardwood Lumber Association; www.nhla.com.
145. NLGA - National Lumber Grades Authority; www.nlga.org.
146. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
147. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
148. NRCA - National Roofing Contractors Association; www.nrca.net.
149. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
150. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
151. NSPE - National Society of Professional Engineers; www.nspe.org.
152. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
153. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
154. NWFA - National Wood Flooring Association; www.nwfa.org.
155. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
156. PDI - Plumbing & Drainage Institute; www.pdionline.org.
157. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
158. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
159. RFCI - Resilient Floor Covering Institute; www.rfci.com.
160. RIS - Redwood Inspection Service; www.redwoodinspection.com.
161. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
162. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
163. SDI - Steel Deck Institute; www.sdi.org.
164. SDI - Steel Door Institute; www.steeldoor.org.
165. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
166. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
167. SIA - Security Industry Association; www.siaonline.org.
168. SJI - Steel Joist Institute; www.steeljoist.org.
169. SMA - Screen Manufacturers Association; www.smainfo.org.

170. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
171. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
172. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
173. SPIB - Southern Pine Inspection Bureau; www.spib.org.
174. SPRI - Single Ply Roofing Industry; www.spri.org.
175. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
176. SSINA - Specialty Steel Industry of North America; www.ssina.com.
177. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
178. STI - Steel Tank Institute; www.steeltank.com.
179. SWI - Steel Window Institute; www.steelwindows.com.
180. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
181. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
182. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
183. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
184. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
185. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
186. TMS - The Masonry Society; www.masonrysociety.org.
187. TPI - Truss Plate Institute; www.tpinst.org.
188. TPI - Turfgrass Producers International; www.turfgrasssod.org.
189. TRI - Tile Roofing Institute; www.tilerroofing.org.
190. UBC - Uniform Building Code; (See ICC).
191. UL - Underwriters Laboratories Inc.; www.ul.com.
192. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
193. USAV - USA Volleyball; www.usavolleyball.org.
194. USGBC - U.S. Green Building Council; www.usgbc.org.
195. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
196. WASTEC - Waste Equipment Technology Association; www.wastec.org.
197. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
198. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
199. WDMA - Window & Door Manufacturers Association; www.wdma.com.
200. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
201. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
202. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
203. WPA - Western Wood Products Association; www.wwpa.org.

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; <http://dodssp.daps.dla.mil>.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <http://eetd.lbl.gov>.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. CBHF - State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR - California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS - California Department of Health Services; (See CDPH).
 4. CDPH - California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC - California Public Utilities Commission; www.cpuc.ca.gov.
 6. SCAQMD - South Coast Air Quality Management District; www.aqmd.gov.
 7. TFS - Texas Forest Service; Forest Resource Development and Sustainable Forestry; <http://txforests-service.tamu.edu>.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014500 – QUALITY CONTROL/LABORATORY TESTING

PART 1 – GENERAL

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A This section describes lab/testing work being contracted by the Owner under a separate agreement. This section also includes the requirements for Contractor cooperation and coordination, to facilitate execution of its required services. The Contractor's cooperation and coordination is part of his Contract requirements. Employment of a testing laboratory by the Owner shall in no way relieve the Contractor of his obligations to perform the Work of his Contract.
- B Where a local building official requires special testing under Chapter 17 of IBC-2015 an approved agency will be employed by the Owner. Coordination by the Contractor is required.

1.2 RELATED DOCUMENTS:

- A Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division - 1 Specification Sections, apply to work of this section.
- B Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities: Sections 00 72 00 and 01 40 00.

1.3 QUALITY ASSURANCE:

- A Qualifications of Laboratory: Testing Laboratory Services are to be provided by a laboratory qualified in accordance with ASTM E-329 "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction," meet "Recommended Requirements for Independent Laboratory Qualification," published by American Council of Independent Laboratories, for asbestos related testing, NVLAP approved and participation in the Pat Program, American Industrial Hygiene Associations and approved by the Architect.
- B Qualifications of Personnel: For actual inspecting and testing, use only personnel who are thoroughly trained and experienced in necessary skills, completely familiar with requirements specified, pertinent portions of Contract Documents, and selected standard for inspecting and testing.
- C Testing Equipment: Calibrated at reasonable intervals by devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
- D Location: Authorized to operate in state in which Project is located.
- E All manufacturer items, articles, materials, and equipment shall be applied, installed, connected, erected, made operative, cleaned, and conditioned as directed by the manufacturers. In case of conflict with the architect's directions, notify the architect in writing with a request for clarification.
- F STANDARDS:
 - i References to various standards (such as ASTM, CRSI, etc.) shall mean the latest edition of the standard prior to the date of these specifications. The standard, by reference to it in these specifications, is made a part of these specifications as though it were written in full in the specifications.
 - ii If no reference is made to establish quality of the work, then the recommendation and standards of the established trade association will apply. In all case the Architect's judgment will be the final authority.
- G COMPATIBLE MATERIALS: The Contractor shall report in writing to the Architect if any specified item or details are not compatible or if they do not interface correctly with adjacent materials. Failure to do so shall imply that the materials are compatible and

meet with the approval of the manufacturer, supplier, applicator, installer, and contractor. Any defects or failures shall be corrected at no additional expense to the Owner or the Architect.

- H ACCEPTANCE OF SURFACES: Starting work on a surface shall be the Contractor's acceptance of the surface as being suitable to receive the work. Any defect or failure due to unsuitable surfaces shall be corrected at no extra cost to the Owner or the Architect. Should any surface not be acceptable to receive work, the person responsible for applying work to the surface shall report it in writing to the Contractor who shall notify the Architect in writing, prior to starting work in said surface.

1.4 TESTING LABORATORY DUTIES:

- A General: Cooperate with Owner, Architect and Contractor; provide qualified personnel and equipment after due notice.
- B Tests: Perform specified inspections, sampling and testing of materials as follows:
 - i Comply with specified standards.
 - ii Ascertain compliance of materials with requirements of Contract Documents.
- C Notification: Promptly notify Owner, Architect and Contractor in writing of observed irregularities or deficiencies of work or products.
- D Additional Tests: Provide additional tests as required by Architect or Owner.
- E Notice: Limitations of Authority of Testing Laboratory: Testing Laboratory is not authorized to release, revoke, alter or enlarge on requirements of Contract Documents; approve or accept any portion of Work; or perform any duties of Contractor.
- F SUBMITTALS: General: Testing laboratory shall promptly submit two (2) copies of written reports of all tests and inspections to both Architect and Contractor. Each report shall include:
 - i Date issued.
 - ii Project title and number.
 - iii Testing laboratory name, address and telephone number.
 - iv Name and signature of laboratory inspector.
 - v Date and time of sampling or inspection.
 - vi Record of temperature and weather conditions.
 - vii Date of test.
 - viii Identification of product and specification section.
 - ix Location of sample or test in the Project.
 - x Type of test or inspection.
 - xi Results of tests and compliance with Contract Documents.
 - xii Interpretation of test results, when so requested by Architect.

1.5 CONTRACTOR'S RESPONSIBILITIES:

- A General: Cooperate with Testing Laboratory personnel, provide access to work.
- B Samples: Secure and deliver to Testing Laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
- C Mix Designs: Contractor shall be responsible for all mix designs. Selection of and payment of services of a testing laboratory for mix designs shall be responsibility of Contractor. Contractor is required to submit to Architect following verified mix designs:
 - i Concrete Design Mix: In advance of concrete and reinforced masonry work, Contractor shall submit a concrete design mix for each strength and type of concrete indicated and/or specified.
- D Product Tests: Furnish to Architect three (3) copies of any product test reports as specified in other sections.
- E Labor and Facilities: Contractor shall furnish all incidental labor and facilities:
 - i To provide access to Work to be tested.

- ii To obtain and handle samples at Project site or at source of products to be tested.
 - iii To facilitate inspections and tests.
 - iv For storage and curing of test samples.
 - F Material Sources: Advise Testing Laboratory of identity of material sources and instruct material suppliers to allow tests or inspections by Laboratory.
 - G Notification: Notify Testing Laboratory sufficiently in advance of operations to allow for Testing Laboratory assignment of personnel and scheduling of tests or inspections.
 - H Note: Contractor shall reimburse OWNER for all tests conducted by Testing Laboratory hired by Owner that fail to meet requirements of Contract Documents. Contractor shall also reimburse OWNER for all schedule tests that are cancelled when a Testing Laboratory field crew is on site at time that particular test is cancelled.
- 1.6 REJECTION OF MATERIALS OR INSTALLATION:
- A General: Testing Laboratory shall notify in writing Owner, Architect and Contractor or Contractor's authorized representative of any material or installation which are not in full compliance with the Contract Documents.
- 1.7 TESTS AND INSPECTIONS REQUIRED:
- A General: Laboratory shall conduct tests and inspections as directed by Owner or Architect or Engineer.
 - B Tests: Following tests and inspections that may be conducted by Testing Laboratory are listed below for Contractors general information only; however, in no way is it suggested that tests or inspections by Testing Laboratory are limited to those listed herein.
 - C SOILS TESTS:
 - i Required Tests: Provide soils tests and inspections as follows for earthwork specified in Section 312320 Earthwork for Structures as indicated:
 - a Classification, compaction, and complete field supervision of fill operations. (Full time inspection)
 - b Minimum number soils tests to be made:
 - b.1) One (1) Proctor Curve for natural ground and each change in natural ground material.
 - b.2) One (1) Proctor Curve for each change in fill material.
 - b.3) One (1) compaction test for each 20 square yards of natural ground and for each 20 square yards of each lift of fill material.
 - c Note: Refer to soil compaction requirements as noted in Section 312320.
 - D CONCRETE TESTS:
 - i Required Tests: Provide concrete tests and inspections as follows for concrete work specified in Section 03 30 00- "Cast-In-Place Concrete" and as indicated:
 - ii Inspection: Prior to concrete placement, inspect forms, rebar count and location, inserts and other embedded items for general conformance with requirements of Drawings and Specifications.
 - a Samples: Sample concrete for slump, temperature and strength as follows:
 - a.1) Samples per ASTM C-172.
 - a.2) Cylinders per ASTM C-31 and ASTM C-39.
 - a.3) Slump per ASTM C-143.
 - b Number of Strength Tests:
 - b.1) One each days concrete placement greater than five (5) cubic yards;
 - b.2) One per 25 to 50 cubic yards; one minimum representative of each concrete element such as footings, slabs, beams, walls, columns, etc. and special major placements such as vaults.
 - c Number of Cylinder per Tests: Three (3) cylinders per test.

- d Test Procedure: Job cure cylinders for 7 days, transfer to Testing Laboratory and break one cylinder for 7 day strength; Laboratory cure remaining cylinders to be broken for 28 day strength.
 - e Test Reports: Test reports shall indicate date of placement and date of breaks, location of placement, mix and strength, air and concrete temperature, slump, results of compression test, amount of water added at Project site.
- E MASONRY TESTS:
- i Required Tests: Provide concrete tests and inspections as follows for concrete work specified in Section 04 20 00 – "Unit Masonry" and as indicated:
 - ii Inspection: Prior to grout placement, inspect forms, rebar count and location, inserts and other embedded items for general conformance with requirements of Drawings and Specifications.
 - a Samples: Sample grout for slump, temperature and strength as follows:
 - a.1) Samples per ASTM C-172.
 - a.2) Cylinders per ASTM C-31 and ASTM C-39.
 - a.3) Slump per ASTM C-143.
 - b Number of Strength Tests:
 - b.1) One each days grout placement greater than one (1) cubic yard;
 - b.2) One per 1 to 5 cubic yards; one minimum representative of each masonry element such as footings, slabs, beams, walls, columns, etc.
 - c Number of Cylinder per Tests: Three (3) cylinders per test.
 - d Test Procedure: Job cure cylinders for 7 days, transfer to Testing Laboratory and break one cylinder for 7 day strength; Laboratory cure remaining cylinders to be broken for 28 day strength.
 - e Test Reports: Test reports shall indicate date of placement and date of breaks, location of placement, mix and strength, air and concrete temperature, slump, results of compression test, amount of water added at Project site.

1.8 SPECIAL INSPECTIONS

- A STRUCTURAL STEEL TESTS: Provide tests and inspections as follows for structural steel, steel joist and girders, and metal deck work specified in Sections 05 12 23, 05 21 19, and 05 31 00 and as indicated:

Verification and Inspection	Frequency	Reference Standard
1. Material verification of high strength bolts, nuts and washers:		
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	Periodic	AISC 360, Section A3.3 and applicable ASTM Standards
b. Manufacturer's certificate of compliance required.	Periodic	
2. Inspection of high strength bolting:		
a. Snug-tight joints	Periodic	AISC 360, Section M2.5 and IBC 1704.3.3
b. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation.	Periodic.	
c. Pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation.	Continuous.	

3. Material verification of structural steel and cold-formed steel deck:		
a. For structural steel, identification markings to conform to AISC 360.	Periodic.	AISC 360, Section M5.5
b. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents.	Periodic.	Applicable ASTM material standards
c. Manufacturer's certified test reports.	Periodic.	
4. Material verification of weld filler materials:		
a. Identification markings to conform to AWS specification in the approved construction document.	Periodic.	AISC 360, Section A3.5 and applicable AWS A5 documents.
b. Manufacturer's certificate of compliance required.	Periodic.	
5. Inspection of welding:		
a. Structural steel and cold-formed steel deck:		
1) Complete and partial penetration groove welds.	Continuous.	AWS D1.1 and IBC 1704.3.1
2) Multipass fillet welds.	Continuous.	
3) Single-pass fillet welds >5/16".	Continuous.	
4) Plug and slot welds.	Continuous.	
5) Single-pass fillet welds ≤5/16".	Periodic.	
6) Floor and roof deck welds.	Periodic.	AWS D1.3
b. Reinforcing Steel.		
1) Verification of weldability of reinforcing steel other than ASTM A706.	Periodic.	AWS D1.4 and ACI 318: Section 3.5.2.
2) Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements of special structural walls of concrete and shear reinforcement.	Continuous.	
3) Shear reinforcement.	Continuous.	
4) Other reinforcing steel.	Periodic.	
6. Inspection of steel frame joint details for compliance:		
a. Details such as bracing and stiffening.	Periodic.	IBC 1704.3.2
b. Member locations.	Periodic.	
c. Application of joint details at each connection.	Periodic.	

Inspection of fabricated items shall be required unless the fabricator is approved by the Building Official to perform work without special inspections.

B MASONRY TESTS: Required Tests: Provide Level 1 tests and inspections of as follows for Unit Masonry work specified in Sections 04 20 00.

Verification and Inspection	Frequency	Reference Standard
1. Compliance with required inspection provisions and the construction documents and the approved submittals shall be verified.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 1.5
2. Verification of f'm prior to construction except where specifically exempted by this code.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 1.4B
3. Verification of slump flow and VSI as delivered to the site for self-consolidating grout.	Continuous.	TMS 602/ACI 530.1/ASCE6, Art. 1.5B.1.b.3
4. As masonry construction begins, the following shall be verified to ensure compliance:		
a. Proportions of site-prepared mortar.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 2.6A
b. Construction of mortar joints.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 3.3B
c. Location of reinforcement, connectors, prestressing tendons and anchorages.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 3.4, 3.6A.
d. Prestressing technique.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 3.6B.
e. Grade and size of prestressing tendons and anchorages.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 2.4B, 2.4H.
5. During construction the inspection program shall verify:		
a. Size and location of structural elements.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 3.3F.
b. Type, size and location of anchors, including other details of anchorage of masonry to structural members, frames or other construction.	Periodic.	TMS 402/ACI 530/ASCE 5, Sec 1.2.2(e), Art. 1.16.1
c. Specified size, grade and type of reinforcement, anchor bolts, prestressing tendons and anchorages.	Periodic.	TMS 402/ACI 530/ASCE 5, Sect 1.15. TMS 602/ACI 530.1/ASCE6, Art. 2.4, 3.4
d. Welding of Reinforcement.	Continuous.	TMS 402/ACI 530/ASCE 5, Sec. 2.1.9.7.2, 3.3.3.4(b).
e. Preparation, construction and protection of masonry during cold weather (temperature below 40F) or hot weather (temperature above 90F).	Periodic.	IBC Section 2104.3, 2104.4; TMS 602/ACI 530.1/ASCE 6, Art. 1.8C, 1.8D.
f. Application and measurement of prestressing force.	Continuous.	TMS 602/ACI 530.1/ASCE6, Art. 3.6B.
6. Prior to grouting, the following shall be verified to ensure compliance:		
a. Grout space is clean.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 3.2D.
b. Placement of reinforcement and connectors, and prestressing tendons and anchorages.	Periodic.	TMS 402/ACI 530/ASCE 5, Sect 1.13.

		TMS 602/ACI 530.1/ASCE6, Art. 3.4.
c. Proportions of site-prepared grout and prestressing grout for bonded tendons.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 2.6B.
d. Construction of mortar joints.	Periodic.	TMS 602/ACI 530.1/ASCE6, Art. 3.3B.
7. Grout placement shall be verified to ensure compliance.	Continuous.	TMS 602/ACI 530.1/ASCE6, Art. 3.5.
a. Grouting of prestressing bonded tendons.	Continuous.	TMS 602/ACI 530.1/ASCE6, Art. 3.6C.
8. Preparation of any required grout specimens, mortar specimens and/or prisms shall be observed.	Periodic.	IBC 2105.2.2, 2105.3; TMS 602/ACI 530.1/ASCE6, Art. 1.4.

C CONCRETE TESTING: Provide tests and inspections as follows for concrete work as specified in Sections 03 33 00 and as indicated:

Verification and Inspection	Frequency	Reference Standard
1 Inspection of reinforcing steel, size and placement.	Periodic	ACI 318: 3.5, 7.1-7.7; IBC 1913.4
2 Inspection of drilled piers:	Continuous During Task	IBC 1704.9
a. Observe drilling operations and maintain complete and accurate records for each element.		
b. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end bearing strata capacity. Record concrete or grout volumes.		
3 Inspection of reinforcing steel welding:		
a. Verification of weldability of reinforcing Steel other than ASTM A706.	Periodic	AWS D1.4, ACI 318: 3.5.2
b. Shear reinforcement	Continuous	
c. Other reinforcing steel.	Periodic	
4. Inspection of bolts to be installed in concrete prior to and during placement.	Continuous	ACI 318: 8.1.3, 21.2.8; IBC 1911.5, 1912.1.
5. Inspection of anchors installed in hardened concrete.	Periodic	ACI 318: 3.8.6, 8.1.3, 21.2.8; IBC 1912.1
6. Verify use of required design mix	Periodic	ACI 318: CH 4, 5.2-5.4; IBC 1904.3, 1913.2, 1913.3
7. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air	Continuous	ASTM: C 172, C 31; ACI 318: 5.6, 5.8; IBC 1913.10

content tests, and determine the temperature of the concrete.		
8. Inspection of concrete placement for proper application techniques.	Continuous	ACI 318: 5.9, 5.10; IBC 1913.6, 1913.7, 1913.8
9. Inspection for maintenance of specified curing temperature and techniques.	Periodic	ACI 318: 5.11-5.13; IBC 1913.9
10. Erection of precast concrete members	Periodic	ACI 318: Ch 16
11. Inspect formwork for shape, location and dimensions of the concrete member being formed.	Periodic	ACI 318: 6.1.1

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION – 01 45 00

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.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 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 FOR TEMPORARY FACILITIES

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top rails.
- B. 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 concrete or galvanized-steel bases for supporting posts.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Securable/Lockable prefabricated or mobile units with adequate space & amenities for review of construction drawings, by the Construction Manager & up to 3 other persons, 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.

2.3 EQUIPMENT FOR TEMPORARY FACILITIES

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service underground unless otherwise indicated.

H. Telephone Service:

1. Provide superintendent with cellular telephone for use at and when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. 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 as indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.

C. Temporary Use of 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 sub-grade and install sub-base and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, re-grading, proof-rolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to 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.

E. Parking: Provide temporary or Use designated areas of Owner's existing parking areas for construction personnel as approved by owner prior to starting construction.

- F. 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.
- G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touchup signs so they are legible at all times.
- H. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- J. 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.
- K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- 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.
- 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.
- C. Temporary Erosion and Sedimentation Control: Comply with[requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and] requirements specified in Section 311000 "Site Clearing."

- D. Storm-water Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm-water from heavy rains.
- E. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin and Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- H. 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 work day.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- 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 weather-tight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
 - 2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
 - 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 4. Insulate partitions to control noise transmission to occupied areas.
 - 5. Seal joints and perimeter. Equip partitions with gasketed, dustproof doors and security locks where openings are required.
 - 6. Protect air-handling equipment.
 - 7. Provide walk-off mats at each entrance through temporary partition.

- 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.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 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. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Discard or replace water-damaged and wet material.
 4. Discard, replace, or clean stored or installed material that begins to grow mold.
 5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: 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. Remove 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. 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

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.2 DEFINITIONS

- A. Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1.4 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements.

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart. High-visibility orange color, non-fading.
2. Height of Fencing: 4 feet.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.2 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones in a manner that will prevent people from easily entering protected area except by entrance gates.
 1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
- C. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

3.3 EXCAVATION

- A. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
- B. Do not allow exposed roots to dry out before placing permanent backfill.

3.4 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.

2. Temporarily support and protect roots from damage until they are permanently covered with soil.
 3. Cover exposed roots with burlap and water regularly.
 4. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune roots by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.5 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- C. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finish elevations.

3.6 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.7 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
1. Perform repairs within 24 hours.
 2. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 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 012500 "Substitution Procedures" for requests for substitutions.

1.2 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. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process 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 specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor **through Construction Manager** of approval

or rejection of proposed comparable product request within **15** days of receipt of request, or **seven** days of receipt of additional information or documentation, whichever is later.

- a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
- b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

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.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for 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 with the Specifications, prepare a written document using indicated form properly executed.
 - 3. Refer to 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.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will be considered unless otherwise indicated.**
 - b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will be considered unless otherwise indicated.**
 - b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. 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 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.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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 and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 3. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two copies signed by land surveyor or professional engineer.
- D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. 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, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element 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.
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.
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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. 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.

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.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, 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. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility or 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to 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. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. General: Engage a land surveyor or professional engineer] to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish 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.
 6. Notify 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.
- 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.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site-work.
- D. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful 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 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.
 - 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. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, 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: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- 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 or prevent 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. 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 minimize evidence of patching and refinishing.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 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 PROGRESS CLEANING

- A. General: 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, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
 - 2. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

1.3 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.

1.4 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
 - 1. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

PRODUCTS (Not Used)

PART 2 - EXECUTION

2.1 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.
- B. 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. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

2.2 DISPOSAL OF WASTE

- A. General: Remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

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. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 017823 "Operation and Maintenance Data" for 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 for instructing Owner's personnel.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 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, final completion construction photographic documentation, 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 Architect or Construction Manager. Label with manufacturer's name and model number where applicable.
 - 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 Architect's or Construction Manager's signature for receipt of submittals.
 - 5. Submit test/adjust/balance 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 heat and other utilities.
 - 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, including touchup painting.
 10. Touch up 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. Re-inspection: Request re-inspection 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.

1.6 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to 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 shall 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.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- 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. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect[, through Construction Manager,] will return annotated copy.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - 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 light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.

- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect, through Construction Manager, will return two copies.
- C. 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 will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- C. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit one paper-copy set of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and one set of file prints.
 - 3) Submit record digital data files and one set of plots.
 - 4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit three paper-copy sets of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and three sets of prints.
 - 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it.
 - c. Record and check the markup before enclosing concealed installations.
 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect through Construction Manager for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. 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.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. Note related Change Orders[, record Product Data,] and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file or paper copy.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders[, record Specifications,] and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file or paper copy.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as [PDF electronic file or paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's[and Construction Manager's] reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc].

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. Pre-instruction 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.

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 content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and 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. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.

- e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.

- C. Narration: Describe scenes on video recording by audio narration by microphone while dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- D. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 024100 - DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Scope of Work:
 - 1. Section includes removal and disposal and/or salvage of pavement, minor structures, utilities and other miscellaneous existing features affecting the project as identified in the Drawings.
 - 2. The Contractor shall furnish all materials, tools, equipment, devices, appurtenances, facilities and services as required for performing the demolition work.

1.2 QUALITY ASSURANCE

- A. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, and disposal.
- B. Conform to applicable State of Louisiana code requirements for procedures when hazardous or contaminated materials are discovered.
- C. Obtain required permits from authorities having jurisdiction.

1.3 SITE CONDITIONS

- A. Protection of Persons and Property:
 - 1. Erect and maintain temporary bracing, shoring, lights, barricades, signs and other measures as necessary to protect the public, workers and adjoining property from damage from demolition work.
 - 2. Open depressions and excavations occurring as part of this work shall be barricaded and posted with warning lights when accessible through adjacent property or through public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 - 3. Protect utilities, pavements and facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by demolition operations.
- B. Protection of Utilities:
 - 1. Protect active sewer, water, gas, electric and other utilities as well as drainage and irrigation lines indicated, or when not indicated, found or otherwise made known to the Contractor before or during demolition work. If utility is damaged, immediately notify the utility owner to schedule corrective action.
 - 2. Arrange with and perform work required by Owner, utility companies and municipal departments for discontinuance or interruption of utility services due to demolition work.
- C. Unknown Conditions:

1. The Drawings and related documents may not represent all surface conditions at the site and adjoining areas. The known surface conditions are as indicated, and shall be compared with actual conditions before commencement of work.
2. Existing utilities and drainage systems below grade are located from existing documents and from surface utilities such as manholes, valve boxes, area drains and other surface fixtures.
3. If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Engineer in writing, requesting instructions on their disposition. Take immediate steps to ensure that the service provide is not interrupted.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREPARATION

- A. Call Louisiana One Call at 1-800-272-3020 not less than three working days before performing Work.
 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Notify affected utility companies before starting work and comply with utility's requirements.
- C. Erect, and maintain temporary barriers and security devices , including warning signs and lights, and similar measures, for protection of the public and existing improvements indicated to remain.

3.2 DEMOLITION REQUIREMENTS

- A. Use of explosives is not permitted.
- B. Conduct demolition to minimize interference with adjacent facilities.
- C. Cease operations immediately when adjacent facilities appear to be in danger. Notify Engineer and do not resume operations until directed.
- D. Conduct operations with minimum interference to public or private accesses to occupied adjacent facilities.

3.3 DEMOLITION

- A. Perform demolition of miscellaneous items as indicated in the Drawings.

- B. Empty underground wetwells or tanks located within demolition area.
- C. Maintain flow of existing sewers through the project site at all times.
- D. Remove underground wetwell, manholes, tanks, components, and piping from site as indicated in the drawings.
- E. Remove materials to be re-installed or retained in manner to prevent damage.
- F. Fill voids, compact and rough grade areas affected by demolition to maintain site grades and contours. Fill material used to fill voids shall be select fill and shall be compacted to 95% Standard Proctor Density.
- G. Continuously clean-up and remove demolished materials from site. Do not allow materials to accumulate on site.
- H. Do not burn or bury materials on site. Leave site in clean condition.

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.2 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.

1.3 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Schedule of selective demolition activities with starting and ending dates for each activity.
- B. Predemolition photographs or video.
- C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

- A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

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: Refer to Section 011000 "Summary" for information, regarding hazardous materials, which will be present during construction.
 - 1. If suspected hazardous materials, beyond those indicated, by said Section 011000, are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- 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.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- G. Arrange selective demolition schedule so as not to interfere with Owner's 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively 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.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

- 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. 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.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. 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.
 - 4. Maintain fire watch during and for at least <Insert number> hours after flame-cutting operations.
 - 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 6. 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 selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction 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.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 03 10 00 - CONCRETE FORMWORK**1. PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.2. PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 03 30 00 - Cast-In-Place Concrete: Supply of concrete accessories for placement by this section.

1.3. RELATED SECTIONS

- A. Section 03 20 00 - Concrete Reinforcement.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 02 36 20 - Drilled Concrete Piers.

1.4. UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Concrete formwork will not be paid for directly but will be included in the cost bid for other items.

1.5. REFERENCES

Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:

- A. 2015 edition of the International Building Code (IBC), including applicable local ordinances and amendments.
- B. ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials."
- C. ACI 301 "Specifications for Structural Concrete for Buildings".
- D. ACI 302 "Guide for Concrete Floor and Slab Construction."
- E. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."
- F. ACI 305 "Hot Weather Concreting."
- G. ACI 306 "Cold Weather Concreting."
- H. ACI 309 Specification for Liquid Membrane Forming Compounds for Curing Concrete."
- I. ACI 315 "Manual of Standard Practice for Detailing Concrete Structures."
- J. ACI 318 "Building Code Requirements for Reinforced Concrete."
- K. ASTM A 123 "Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel."
- L. ASTM "Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement."
- M. ASTM A 615 "Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."
- N. ASTM A 706 "Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement."
- O. ASTM C 31 "Method of Making and Curing Concrete Test Specimens in the Field."
- P. ASTM C 33 "Specification for Concrete Aggregates."
- Q. ASTM C 39 "Test Method for Compressive Strength of Cylindrical Concrete Specimens."
- R. ASTM C94 "Specification for Ready Mix Concrete."
- S. ASTM C 143 "Test Method for Slump of Portland Cement Concrete."

- T. ASTM C 150 "Specification for Portland Cement."
 - U. Concrete Reinforcing Steel Institute, (CRSI) "Manual of Standard Practice," latest edition.
 - V. Concrete Reinforcing Steel Institute, (CRSI) "Manual of Standard Practice and Specifications for Placing Reinforcement," latest edition.
- 1.6. DESIGN REQUIREMENTS
- A. Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.
- 1.7. SUBMITTALS
- A. Submit under provisions of Section 01300.
 - B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
 - C. Product Data: Provide data on void form materials [and installation requirements].
- 1.8. QUALITY ASSURANCE
- A. Perform Work in accordance with ACI 318.
- 1.9. QUALIFICATIONS
- A. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the state where the Project is located.
- 1.10. REGULATORY REQUIREMENTS
- A. Conform to applicable code for design, fabrication, erection and removal of formwork.
- 1.11. FIELD SAMPLES
- A. Provide under provisions of Section 01400. Coordinate with requirements stated in Section 03100 and 03300.
- 1.12. DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
 - B. Deliver void forms and installation instructions in manufacturer's packaging.
 - C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.
- 1.13. COORDINATION
- A. Coordinate work under provisions of Section 01039.
 - B. Coordinate this Section with other Sections of work which require attachment of components to formwork.
 - C. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.
2. PART 2 PRODUCTS
- 2.1. WOOD FORM MATERIALS
- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

- B. Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class I.
 - C. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
 - D. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- 2.2. FORMWORK ACCESSORIES
- A. Form Ties: Snap-off type, metal, adjustable length, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.
 - B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.
 - C. Corners: Chamfer, wood strip 1x 1 inch size; maximum possible lengths
 - D. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, release tape sealed slots, anchors for securing to concrete formwork.
 - E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
 - F. Waterstops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; manufactured by Greenstreak.
3. PART 3 EXECUTION
- 3.1. EXAMINATION
- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.
- 3.2. EARTH FORMS
- A. All grade beams shall be formed. Earth Forms are not acceptable.
- 3.3. ERECTION - FORMWORK
- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
 - B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
 - C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
 - D. Align joints and make watertight. Keep form joints to a minimum.
 - E. Obtain approval before framing openings in structural members which are not indicated on Drawings.
 - F. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- 3.4. APPLICATION - FORM RELEASE AGENT
- A. Apply form release agent on formwork in accordance with manufacturer's

recommendations.

- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are effected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5. INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Position recessed reglets for brick veneer masonry anchors to spacing and intervals specified in Section 04300.
- E. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- F. Install waterstops continuous without displacing reinforcement.
- G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6. FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7. FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.

3.8. FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- B. Do not reuse wood formwork more than 1 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9. FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION 03 10 00

SECTION 031521 - TERMITE BARRIER

PART ONE - GENERAL

DESCRIPTION

Provide soil treatment for termite control under and around buildings or construction as described below.

Provide termite treatment on existing wood sleeper system at auditorium once existing flooring is removed and prior to installation of new wood floor.

RELATED WORK SPECIFIED ELSEWHERE

General & Supplementary Conditions, Special Requirements:

Earthwork: Section 02200

Cast-in-Place Concrete: Section 03300

QUALITY ASSURANCE

Applicator shall be registered or licensed as required by state or other governing jurisdictions.

Applicator shall comply with termite control requirements of the state or other governing jurisdictions and with the requirements of this Specification where it exceeds other requirements. Should Government Regulations outlaw or restrict use of any pesticide as specified, Contractor shall submit revised and equal treatment to Architect prior to application.

GUARANTEE

Deliver to the Owner a bonded guarantee that the below listed requirements have been met and that re-treatment will be made, without cost to Owner, on evidence of termite infestation within a period of five (5) years after date of Substantial Completion. Re-treatment material shall be same quality and rate of concentration as originally used materials.

SUBMITTALS

Before proceeding with the work, provide Architect with manufacturer's mixing and application instructions.

PART TWO - PRODUCTS

MATERIALS

Apply one of the listed chemicals, at not less than the designated concentration, to areas to be treated:

Permethrin (Dragnet FT & Torpedo): 0.5 – 1.0 percent applied in water emulsion.

Biflex TC: 0.06 – 0.12 percent applied in water emulsion.

Demon: 0.25 – 0.50 percent applied in water emulsion.

Bifenthrin: .0.06 – 0.12 percent applied in water emulsion

Cypermethrin: 0.25 – 0.50 percent applied in water emulsion

Imidacloprid: 0.05 – 0.10 percent applied in water emulsion

Proprietary materials, which pass a 5-year test by U. S. Forest Service or U. S. Department of Agriculture, and contain one or more of the above chemicals in the proper concentrations, and can provide proof that no toxic effect will result in human, beneficial plant or animal life, are acceptable. Contractor shall not use any material that is banned or prohibited by any U. S. Government Agency. If any such material is called for herein, Contractor shall notify Architect, who will select an acceptable substitute.

MIXES

Follow manufacturer's mixing instructions.

PART THREE - EXECUTION

INSPECTION

Notify Architect 48 hours prior to planned application of chemicals. Do not proceed without approval of Architect.

Do not begin work until all fill under slabs has been compacted, and after piping and other sub-slab work is in place. Treat before installation of vapor barrier.

Verify that soil is in friable condition with moisture content low enough to permit absorption of toxicant solution.

APPLICATION

Apply to areas beneath concrete floor slabs on grade or fill, and along both sides of interior and exterior grade beams.

Apply also at expansion joints, construction joints, conduit, piping and other construction

penetrations through slabs.

SLABS ON GRADE: One (10) gallon to each ten (10) square feet of area within building lines.

GRADE BEAMS: One (1) gallon (each side) for each for (4) lineal feet of grade beam.

EXPANSION AND CONSTRUCTION JOINTS: Two (2) gallons for each five (5) linear feet of joint.

PIPE CONDUITS & OTHER SLAB PENETRATIONS: Two (2) gallons for each seven (7) square feet for a minimum radius of three (3) feet from penetration.

PROTECTION

Allow not less than 12 hours for drying after application, before beginning concrete placement or other construction activities.

Cover areas immediately following application of material.

Provide protection necessary to prevent human and animal contact with treatment materials and with treated surfaces.

Protect persons from injury and property damage. Satisfactorily repair or remove and replace work that has been damaged.

CLEANING

Clean adjacent surfaces not intended for treatment from soil, stain and adhered materials. Remove and replace damaged work that cannot be restored to original conditions.

Remove excess material and debris from site.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCEMENT

1. PART 1 GENERAL

1.1. SECTION INCLUDES

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.2. RELATED SECTIONS

- A. Section 03 10 00 - Concrete Formwork.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 02 36 20 – Drilled Concrete Piers.

1.3. UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Concrete reinforcement shall not be paid for directly but shall be included in the prices bid for other items.

1.4. REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements For Reinforced Concrete.].
- C. ACI SP-66 - American Concrete Institute - Detailing Manual.
- D. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
- E. ANSI/ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- F. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- G. ANSI/ASTM A496 - Deformed Steel Wire Fabric for Concrete Reinforcement.
- H. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- I. ANSI/AWS D1.4 - Structural Welding Code for Reinforcing Steel.
- J. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- K. ASTM A616 - Rail Steel Deformed and Plain Bars for Concrete Reinforcement.
- L. ASTM A617 - Axle Steel Deformed and Plain Bars for Concrete Reinforcement.
- M. ASTM A704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
- N. ASTM A706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
- O. ASTM A767 - Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.
- P. ASTM A775 - Epoxy-Coated Reinforcing Steel Bars.
- Q. ASTM D3963 - Epoxy-Coated Reinforcing Steel.
- R. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
- S. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.
- T. CRSI 63 - Placing Reinforcing Bars.
- U. ASTM A884 - Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

1.5. SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices and.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6. QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI - Manual of Standard Practice, ACI 301, and ACI 318.
- B. Submit certified copies of mill test report of reinforcement materials analysis.

- C. Provide Architect/Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.
- 1.7. QUALIFICATIONS
- A. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State where the Project is located.
 - B. Welders' Certificates: Submit under provisions of Section 01400 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
- 1.8. COORDINATION
- A. Coordinate work under provisions of Section 01039.
 - B. Coordinate with placement of formwork, formed openings and other Work.
2. PART 2 PRODUCTS
- 2.1. REINFORCEMENT
- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, unfinished
 - B. Welded Reinforcing Steel: ASTM A706, 60 ksi yield grade; deformed low-alloy steel bars, unfinished.
 - C. Welded Steel Wire Fabric: ASTM A185 in flat sheets unfinished
- 2.2. ACCESSORY MATERIALS
- A. Tie Wire: Minimum 16 gage annealed type
 - B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
 - C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.
- 2.3. FABRICATION
- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.
 - B. Weld reinforcement in accordance with AWS D1.4.
 - C. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Architect/Engineer.
3. PART 3 EXECUTION
- 3.1. PLACEMENT
- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
 - B. Do not displace or damage vapor barrier.
 - C. Accommodate placement of formed openings.
 - D. Maintain concrete cover around reinforcing as follows:
 - E. Conform to ACI 318-02 code for concrete cover over reinforcement.
 - F. Bond and ground all reinforcement to requirements of Section 16170.
- 3.2. FIELD QUALITY CONTROL
- CONCRETE REINFORCEMENT

- A. Field inspection will be performed under provisions of Section 01 45 00.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

- A Cast-in-place concrete.
- B Floors and slabs on grade.
- C Control, expansion and contraction joint devices associated with concrete work, including joint sealants.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A Section 03100 - Concrete Formwork.

1.3 RELATED SECTIONS

- A Section 031000 - Concrete Formwork: Formwork and accessories.
- B Section 032000 - Concrete Reinforcement.

1.4 REFERENCES

- A ACI 301 - Structural Concrete for Buildings.
- B ACI 302 - Guide for Concrete Floor and Slab Construction.
- C ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- D ACI 305R - Hot Weather Concreting.
- E ACI 306R - Cold Weather Concreting.
- F ACI 308 - Standard Practice for Curing Concrete.
- G ACI 318 - Building Code Requirements for Reinforced Concrete.
- H ANSI/ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- I ANSI/ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.
- J ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- K ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- L ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
- M ASTM C33 - Concrete Aggregates.
- N ASTM C94 - Ready-Mixed Concrete.
- O ASTM C150 - Portland Cement.
- P ASTM C260 - Air Entraining Admixtures for Concrete.
- Q ASTM C330 - Light Weight Aggregates For Structural Concrete.
- R ASTM C494 - Chemicals Admixtures for Concrete.
- S ASTM C618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.5 SUBMITTALS

- A Submit under provisions of Section 01300.
- B Product Data: Provide data on joint devices, attachment accessories, admixtures.
- C Samples: Submit two, 12 inch long samples of expansion/contraction joint and control joint.

- D Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.
- 1.6 PROJECT RECORD DOCUMENTS
 - A Submit under provisions of Section 01700.
 - B Accurately record actual locations of embedded utilities and components which are concealed from view.
- 1.7 QUALITY ASSURANCE
 - A Perform Work in accordance with ACI 301.
 - B Acquire cement and aggregate from same source for all work.
 - C Conform to ACI 305R when concreting during hot weather.
 - D Conform to ACI 306R when concreting during cold weather.
- 1.8 FIELD SAMPLES
 - A Provide under provisions of Section 01400. Coordinate with Section 03100.
 - B Construct and erect a field sample for architectural concrete surfaces receiving special treatment or finish as result of formwork.
 - C Sample Panel: Sufficient size to indicate special treatment or finish required.
 - D If requested by Architect/Engineer, cast concrete against sample panel. Obtain acceptance of resultant surface finish prior to erecting formwork.
 - E Locate as directed in field by Architect or Owner's construction manager.
 - F Accepted sample panel is considered basis of quality for the finished work. Keep sample panel exposed to view for duration of concrete work.
 - G Accepted sample may not remain as part of the Work.
- 1.9 COORDINATION
 - A Coordinate work under provisions of Section 01039.
 - B Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.
- 2. PART 2 PRODUCTS
- 2.1 CONCRETE MATERIALS
 - A Cement: ASTM C150, Type I. Obtained from a single source.
 - B Fine and Coarse Aggregates: ASTM C33.
 - C Water: Clean and not detrimental to concrete.
- 2.2 ADMIXTURES
 - A Air Entrainment: ASTM C260;.
 - B Chemical: ASTM C494 Type A - Water Reducing; Type B – Retarding; Type C – Accelerating; Type D - Water Reducing and Retarding; Type E - Water Reducing and Accelerating;.
 - C Fly Ash, Calcinated Pozzolan: NOT ALLOWED.
- 2.3 ACCESSORIES
 - A Bonding Agent: Polyvinyl Acetate.
 - B Vapor Barrier: 15 mil thick Stego Wrap clear polyethylene film type recommended for below grade application.
 - C Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive

strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.4 JOINT DEVICES AND FILLER MATERIALS

- A Joint Filler Type A; Asphalt impregnated fiberboard or felt, ½ inch thick; tongue and groove profile.
- B Construction Joint Devices: Integral galvanized steel; as detailed, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.
- C Sealant and Primer: as specified in Section 07900.

2.5 CONCRETE MIX

- A Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.
- B Select proportions for normal weight concrete in accordance with ACI 301 Method 1..
- C Provide concrete to the following criteria:
 - i 4”/5” slab-on-grade, 3500-psi, 28-day compressive strength; water-cement ratio, 0.48 maximum, 4” maximum slump, 1” max nominal aggregate, hard trowel finish, No Air.
 - ii Footings/Grade Beams, 3500-psi, 28-day compressive strength; water-cement ratio, 0.48 maximum (air-entrained), 4” maximum slump.
 - iii Drilled Piers, 3000 psi 28-day compressive strength; water-cement ratio 0.52 maximum; 6”-8” slump; 1½” nominal aggregate (air entrained).
 - iv Miscellaneous: 3000-psi, 28-day compressive strength; water-cement ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained).
- D Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.
- E Calcium chloride shall NOT be used.
- F Use set retarding admixtures during hot weather only when approved by Architect/Engineer.
- G Add air entraining agent to normal weight concrete mix for work exposed to exterior.
- H Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

3. PART 3 EXECUTION

3.1 EXAMINATION

- A Verify site conditions under provisions of Section 01039.
- B Verify requirements for concrete cover over reinforcement.
- C Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

- A Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- B In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.3 PLACING CONCRETE

- A Place concrete in accordance with ACI 318.

- B Notify Architect/Engineer minimum 96 hours prior to commencement of operations.
- C Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and are not disturbed during concrete placement.
- D Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by taping edges and ends.
- E Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight.
- F Separate slabs on grade from vertical surfaces with ½" inch thick joint filler.
- G Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- H Extend joint filler from bottom of slab to within 1/8 inch of finished slab surface. Conform to Section 07900 for finish joint sealer requirements.
- I Install joint devices in accordance with manufacturer's instructions.
- J Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- K Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor finish.
- L Install joint covers in longest practical length, when adjacent construction activity is complete.
- M Apply sealants in joint devices in accordance with Section 07900.
- N Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- O Place concrete continuously between predetermined expansion, control, and construction joints.
- P Do not interrupt successive placement; do not permit cold joints to occur.
- Q Place floor slabs and saw cut pattern indicated.
- R Saw cut joints within 2 hours of placing. Use 3/16 inch thick blade, cut into ¼ depth of slab thickness. All joints to be cut using the SoffCut system.
- S Screed floors and slabs on grade level, maintaining surface flatness of maximum 3/16 inch in 10 ft.

3.4 SEPARATE FLOOR TOPPINGS

3.5 CONCRETE FINISHING

- A Slab Finishing - General Requirements. Unless specified elsewhere, slabs shall be troweled to a smooth hard finish in accordance with ACI 302 for the class of slab specified on the plans.
 - i Strikeoff and Consolidation All slab surfaces shall be placed by the use of continuous mechanical vibratory screeds which are straight and which have been supported by chairs or other approved methods to give surfaces which are within the specified tolerances. Screeds shall be advanced as quickly as proper consolidation allows. Wet screeding shall only be used as approved by the Engineer. All screed operations shall be completed before any excess moisture or bleeding water is present on the surface.
 - ii Leveling. Immediately following screeding operations, the surface shall be leveled by the Highway Straightedge or bullfloating methods as required to produce the specified finished tolerances. All leveling operations shall be completed prior to any excess moisture or bleed water is present on the surface.
 - iii Edging and Jointing. Immediately following the leveling procedure, all edging or jointing as indicated on the plans or specified herein shall be completed. All jointed

surfaces which are indicated as being saw-cut shall not be jointed. A straight edge shall be used for all jointing operations. All edging and jointing operations shall not commence until all excess and bleed water has left the surface or been mechanically removed.

- iv Floating. All concrete surfaces shall be floated after edging and jointing operations are complete. Floating shall not begin until the concrete surface will support a finisher and knee boards with no more than 1/4" indentation or when the power float machine will neither dig in nor disrupt the level of the surface.
- v Troweling. All concrete finishes so noted shall be troweled. Troweling operations shall commence immediately after floating. No surfaces shall be troweled without first being power or hand floated. Surfaces shall be worked smooth to a good hard even surface, free from tool marks and other defects, and finished according to best practice. Successive trowelings may be needed to insure the proper finish and surface density as specified. Each successive troweling shall be made with smaller trowel blades at greater angles.
- vi Protection During Curing. Concrete shall not be applied when weather conditions are unsuitable or else temporary protection (canvas, polyethylene) shall be supplied during finishing and setting period.
 - a Burlap Drag Finish. Before the concrete becomes nonplastic, finish the surface of the slab by dragging on the surface a strip of clean, wet burlap measuring from 3 to 10 feet long and 2 feet wider than the width of the pavement. Select the dimension of the burlap drag so that at least 3 feet of the material is in contact with the pavement. Drag the surface in such a manner as to produce a finished surface with a fine granular or sandy texture without leaving disfiguring marks.

OR

- b Fine broom finish. Apply trowel finish as specified, immediately followed by slightly scarifying the surface with a fine broom.
- vii Non-slip Broom Finish. Apply non-slip broom finish to exterior concrete platforms, steps, and ramps and elsewhere as indicated. Immediately after trowel finishing, slightly roughen concrete surface by brooming in a direction perpendicular to the main traffic route. Coordinate required final finish with engineer before application.
- B Tolerances. In accordance with ACI 117 Section 4.5.7 as scheduled on the drawings.
- C The contractor shall remedy any floor section measuring below either of the minimum local values for flatness or levelness by grinding or by removal and replacement of the affected areas. Under no circumstance will filling of low spots be permitted. All costs for corrective work will be borne by the Contractor.
- D Concrete Surfaces Exposed to View. Vertical and horizontal surfaces shall receive a rubbed finish.
- E Concrete Surfaces Not Exposed to View. Unless specified elsewhere, surfaces shall receive a broom finish or shall be floated in such a manner to provide a granular matte appearance.

3.6 CURING AND PROTECTION

- A General. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in

accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

- B Curing Methods. Perform final curing of concrete by one of following methods at Contractor's option.
- i Moisture Curing. Keeping the surface of the concrete continuously wet by covering with water.
 - ii Moisture - Cover. Moisture retaining cover shall be placed on surfaces for curing period.
 - iii Liquid Membrane applied to damp concrete surfaces as water film has disappeared in accordance with manufacturer's directions. The entire exposed surface of the concrete shall be sprayed uniformly with white pigmented curing compound immediately after completion of surface finishing as soon as surface water evaporates. If the pavement is cured initially with burlap mats and mats are removed prior to expiration of 72 hours, curing compound shall be applied immediately. Curing compound shall not be applied during rainfall.
 - a Curing compound shall be applied under pressure by mechanical sprayers at the rate recommended by the manufacturer but in no case less than 1 gallon per 100 square feet of surface area. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At time of use, the compound shall be thoroughly mixed. During application, the compound shall be stirred continuously by mechanical methods. Hand spraying of odd widths or shapes and on surfaces exposed by form removal will be permitted provided curing compound has been thoroughly agitated prior to placing in the sprayer. Curing compound shall not be applied to inside faces of joints to be sealed. In split slab construction, curing compound shall be applied in such manner as to prevent spraying exposed reinforcing steel.
 - b Should the film become damaged within the curing period, the damaged portions shall be repaired immediately with additional compound.
- C Upon removal of side forms, exposed sides of slabs shall be protected immediately with a curing treatment equal to that provided for the surface.
- D Exposed reinforcing steel and joints shall be covered or shielded to prevent contact with curing compound.
- E Temperature of Concrete During Curing. When the atmospheric temperature is 40 deg. F. and below, maintain the concrete temperature between 50 and 70 deg. F. continuously throughout the curing period. When necessary, make arrangements before concrete placing for continuous heating, covering, insulation, or housing as required for the concrete curing period. Provide cold weather predictions complying with the requirements of ACI 306.

3.7 FIELD QUALITY CONTROL

- A Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section 01400.
- B Provide free access to Work and cooperate with appointed firm.
- C Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- D Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
- E Three concrete test cylinders will be taken for every 50 or less cu yds of each class of concrete placed.
- F One additional test cylinder will be taken during cold weather concreting, cured on job

site under same conditions as concrete it represents.

- G One slump test will be taken for each set of test cylinders taken.
- 3.8 PATCHING
- A Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
 - B Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.
 - C Patch imperfections as directed.
- 3.9 DEFECTIVE CONCRETE
- A Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
 - B Repair or replacement of defective concrete will be determined by the Architect/Engineer.
 - C Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION 03 30 00

SECTION 033000 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls and Grade beams.
 - 3. Slabs-on-grade.
 - 4. Slabs-on-metal deck.
- B. Related Sections:
 - 1. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Engineer.

- E. Samples: For waterstops and vapor retarder.
- F. Qualification Data: For Installer and manufacturer.
- G. Welding certificates.
- H. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Waterstops.
 - 5. Curing compounds.
 - 6. Bonding agents.
 - 7. Vapor retarders.
 - 8. Semirigid joint filler.
 - 9. Repair materials.
- I. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- J. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- K. Field quality-control reports.
- L. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with LaDOTD requirements for production facilities and equipment.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete,"
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Special concrete finish subcontractor.
 2. Review testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified

formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- C. Deformed-Steel Wire: ASTM A 496/A 496M.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F or C.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal. (Unless noted otherwise)
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Axim Italcementi Group, Inc.; CATEXOL CN-CI.
 - b. BASF Construction Chemicals - Building Systems; Rheocrete CNI.

- c. Euclid Chemical Company (The), an RPM company; ARRMATECT, EUCON BCN, EUCON CIA.
 - d. Grace Construction Products, W. R. Grace & Co.; DCI.
 - e. Sika Corporation; Sika CNL.
- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals - Building Systems; Rheocrete 222+.
 - b. Cortec Corporation; MCI- 2000.
 - c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
 - d. Sika Corporation; FerroGard 901.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Meadows, W. R., Inc.; PMPC 15 mil.
 - b. Reef Industries, Inc.; VaporGuard 15 mil.
 - c. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals - Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.
 - i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
 - k. Meadows, W. R., Inc.; EVAPRE.
 - l. Metalcrete Industries; Waterhold.

- m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
 - r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
- a. Anti-Hydro International, Inc.; AH Clear Cure WB.
 - b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
 - c. ChemMasters; Safe-Cure & Seal 20.
 - d. Conspec by Dayton Superior; Cure and Seal WB.
 - e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
 - f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
 - g. Edoco by Dayton Superior; Spartan Cote WB II.
 - h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
 - i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
 - j. Lambert Corporation; Glazecote Sealer-20.
 - k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
 - l. Meadows, W. R., Inc.; Vocomp-20.
 - m. Metalcrete Industries; Metcure.
 - n. Nox-Crete Products Group; Cure & Seal 150E.
 - o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
 - p. TK Products, Division of Sierra Corporation; TK-2519 WB.
 - q. Vexcon Chemicals, Inc.; Starseal 309.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 20 percent.
 2. Silica Fume: 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Grade Beams, Footings & Piers: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: As indicated at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 3. Slump Limit: 4 inches, plus or minus 1 inch.
- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: As indicated at 28 days.
 2. Minimum Cementitious Materials Content: 520 lb/cu. yd..
 3. Slump Limit: 4 inches plus or minus 1 inch.
 4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- C. Slabs-on-Metal Deck: Proportion normal-weight concrete mixture for interior floors as follows:
1. Minimum Compressive Strength: As indicated.
 2. Slump Limit: 5 inches (100 mm), plus or minus 1 inch (25mm) prior to addition of water-reducing admixture.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 2. Class D, 1 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that do not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

- A. Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

- C. Granular Course: Place vapor retarder on granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

- 1. Place and compact a 1/2-inch-thick layer of fine-graded granular material over granular fill.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at locations indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 96 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings, to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.

- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

- a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
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, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, 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 laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
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.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency

may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

SECTION 033513 – EXPOSED POLISHED CONCRETE FLOORING

PART 1 – GENERAL

1.1 SUMMARY

A. Work includes furnishing and installing a full aggregate exposed, polished concrete floor system on a laser-screeded cast-in-place slab.

B. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete
2. Section 07 92 00 – Joint Sealants

1.2 SUBMITTALS

A. Product data for grinding/polishing equipment, densifier/sealer, and joint filler.

B. Concrete mix design.

C. Sample 4'x4' mock-up for approval showing full aggregate exposure and finish sheen.

D. Maintenance instructions.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 3 years experience with exposed polished concrete.

B. Comply with the latest editions of:

1. ACI 302 – Guide for Concrete Floor and Slab Construction
2. ACI 117 – Tolerances for Concrete Construction
3. Concrete Polishing Council (CPC) Guidelines

1.3 MOCK-UP

A. Provide a minimum 4'x4' sample on project slab for review of aggregate exposure, sheen, and joint detailing.

B. Approved mock-up shall serve as quality benchmark.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in dry, protected conditions.

B. Protect finished slab from staining during construction.

PART 2 – PRODUCTS

2.1 CONCRETE MIX

- A. Compressive Strength: 4,000 psi minimum at 28 days.
- B. Aggregate: 3/4" max coarse aggregate
- C. Slump: 5–6" prior to any water-reducing admixtures
- D. Air Content: Not to exceed 3% (interior only, no air entrainment)
- E. Admixtures: Water reducer and superplasticizer as needed; no calcium chloride

2.2 SLAB CONSTRUCTION EQUIPMENT

- A. Use **laser screed equipment** to place and level slab to required flatness.
- B. Final finish: Pan float and trowel finish suitable for polishing.

2.3 POLISHING MATERIALS

- A. Densifier: Lithium- or sodium-silicate based, VOC-compliant
- B. Grouting Material: Approved filler for pinholes and minor surface voids
- C. Joint Filler: Polyurea, color to match concrete tone
- D. Grinding Equipment: Planetary grinder with dust control and multiple grit pads

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify concrete mix, placement tolerances, and curing compliance.
- B. Ensure slab is free of curing compounds, sealers, or surface contaminants.

3.2 PLACEMENT

- A. Place slab using **laser screed**.
- B. Achieve flatness tolerances of **FF 50 / FL 35** minimum.
- C. Sawcut control joints as shown on drawings; protect joint edges from chipping.

3.3 POLISHING PROCESS

- A. Begin grinding once slab has reached sufficient strength and moisture content.
- B. Grind to expose **full aggregate (Class C exposure)**.
- C. Sequential grinding and polishing:
 - 1. 40–80 grit metal
 - 2. Densifier application
 - 3. 100–400 grit resin pads (or as scheduled)

- D. Final sheen: Satin finish unless noted otherwise.
- E. Fill joints and surface imperfections after initial grinding.
- F. Clean and protect slab after final polishing.

3.4 PROTECTION

- A. Cover slab with breathable protection after polishing until substantial completion.
- B. Avoid staining, oil, paint, or damage from trades.

SECTION 033523 - EXPOSED AGGREGATE CONCRETE FINISHING

PART I- GENERAL

1.01 SUMMARY

A Section Includes

1. Finishing materials and methods for producing decorative exposed aggregate slab and wall finish, including the use of chemical surface retarders
2. Curing and sealing of concrete surfaces.

B Related Sections

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections
2. Section 03 30 00 Cast in Place Concrete

1.02 REFERENCES

A ASTM International (www.astm.org)B American Concrete Institute (www.concrete.org)

1.03 ADMINISTRATIVE REQUIREMENTS

1.04 A Pre-Installation Conference:

1. Attendance: Shall be Architect, Owner, Contractor, Construction Manager, installer, and all related trades.
2. Review: Project conditions, manufacturer requirements, delivery, and storage, staging and sequencing, and protection of completed work.

1.05 SUBMITTALS

A Action Submittal

1. Shop Drawings including patterns and exposure depths
2. Product Data: Manufacturer's descriptive data and product attributes for each product.
3. Samples: Provide samples for Architect selection.

B Informational Submittal

1. VOC Compliance [if Applicable.]
 - a. Based on SCAQMD Rule 1113 for VOC compliance
 - i. Concrete surface retarder, not to exceed 250 g/l or comply with the low solids exception of less than 80 g/l.
 - ii. Sealers, not to exceed 100 g/l.

- b. Or CDPH Standard 1.2 VOC Emissions compliant

1.06 QUALITY ASSURANCE

- A Installer Qualifications: Minimum 5 years' experience in work of this Section.
- B Mockups: Minimum [4 x 4] feet. Show each concrete color and finish.
 - 1. Prepare mock-up panel(s) at the project site to demonstrate proficiency of the contractor as well as determine the best procedures and degree of aggregate exposure.
 - 2. Contractor shall use the methods and materials proposed for use on the final installation. Uniformity in appearance of each panel shall be the responsibility of the contractor.
 - 3. Mockups shall be maintained for the duration of the project
- C Review: Project conditions, manufacturer requirements, delivery, and storage, staging and sequencing, and protection of completed work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide products by Solomon Colors, Inc.; 4050 Color Plant Rd., Springfield, IL. 62702; or comparable products by one of the following.
 - 1. Tel: (800) 624-0261; Website: www.solomoncolors.com
Contact: ArchitecturalTeam@SolomonColors.com
 - 2. Sika USA Tel. (201) 933-8800
 - 3. Bomanite Tel. (303) 369-1115
- B. Substitutions: Refer to Division 01.

- c. MATERIALS

- A Concrete Materials: Specified in Section 033000.
 - 1. Aggregate Considerations: Graded and washed aggregate and sand to achieve consistent appearance.
 - a. Special size/color aggregate to be approved at mockup
 - b. Ratio of sand to aggregate per manufacturer's recommendation to achieve the desired exposure depth and appearance.
 - c. Single Source Cements and Aggregates for batch consistency for the entire project.
- B Colloidal Silica Concrete Surface Treatment: Single component colloidal silica-based

admixture for improving surface properties; Reducing efflorescence in colored concrete, improving workability for consistent aggregate exposure, Improving the bond between aggregate and concrete paste for more durable exposed aggregate finishes.

1. Product: Day 1 Surface Technology by Solomon Colors, Inc. www.solomoncolors.com

- a. Material Type: Water-based, colloidal silica blended surfactant
- b. VOC Content: < 50 grams per liter.
- c. VOC Emissions: CDPH Standard 1.2 VOC Emissions certified

C Fibrous Reinforcement: Cellulose micro-fiber designed to provide secondary reinforcement.

D Reduces plastic shrinkage cracking and remains invisible on decorative surfaces. Provides superior finishing qualities, while cleanly accepting color and decorative finishes.

1. Product: UltraFiber 500 by Solomon Colors, Inc. www.solomoncolors.com

- a. Material: Alkali-resistant natural cellulose fibers.
- b. Meet ASTM A820/A820M, ASTM D7357, and ASTM C1116, Section 4.1.4, Type IV.
- c. Stability: Exceed ICC-ES requirements of 90 percent average Zero-Span Stability Ratio (ZSSR) after exposure to saturated calcium hydroxide and 1.0N sodium hydroxide, tested to ASTM D6942.

E Color Pigment: Iron oxide concrete pigment meeting ASTM C979/C979M; light-fast, insoluble, and alkali resistant, in powdered, liquid, or granular form.

- 1. Source: Iron Oxide Pigment or Brickform Powdered Integral Color by Solomon Colors, Inc. www.solomoncolors.com
- 2. Color: To be selected from manufacturer's full color range.

F Surface Retarder: Water based treatment designed to retard the hydration of top layer of concrete paste, producing an exposed aggregate, or sand finish appearance. Product may be used on both horizontal and vertical surfaces

- 1. Source: Brickform Select-Etch by Solomon Colors, Inc. www.solomoncolors.com
- 2. Exposure depth:

Item #	Color	Agg Exposure	Exposure Depth
SE01	White	Light Acid Wash	Light Acid Wash (0.1 mm)
SE03	Violet	Acid Wash	Acid Wash (0.2 mm)
SE05	Light Blue	Sandblast	Sandblast (0.5 mm)
SE15	Yellow	1/8" - 1/4"	1/32" (0.8 mm)
SE25	Beige	1/8" - 1/4"	1/16" (1.5 mm)
SE50	Light Green	1/8" - 3/8"	3/32" (2.4 mm)

SE75	Blue	1/8" - 3/8"	1/8" (3.2 mm)
SE100	Gray	3/8" - 1/2"	5/32" (4 mm)
SE125	Pink	3/8" - 5/8"	3/16" (4.5 mm)
SE150	Green	3/8" - 5/8"	7/32" (5.5 mm)
SE200	Salmon	5/8" - 1"	1/4" (6.5 mm)
SE250	Orange	1" - 1 1/2"	9/32" (7 mm)

G Curing and Sealing: Curing and sealing products to be determined at time of mockup. Some products or methods may not be compatible with project requirements. Considerations include VOC requirements, desired sheen, color enhancement, and environmental conditions. Refer to Solomon Colors' product data for assistance with selecting the proper curing and sealing product(s).

1. Concrete Curing Compound: Clear, film-forming curing/sealing compound, suitable for decorative concrete. Reference ACI 310R
 - a. [Water-based] [Solvent-Based]
 - b. Product: Brickform Gem Cure and Seal by Solomon Colors, Inc._
www.solomoncolors.com
2. Concrete Surface Sealer: VOC compliant, clear acrylic or penetrating sealer, designed to reduce porosity of exposed aggregate concrete surface
 - a. Water-Based Acrylic Sealer: Film forming, satin sheen
 - i. Product: Brickform Gem Cure and Seal WB by Solomon Colors, Inc._
www.solomoncolors.com
 - ii. Product: Brickform Stealth Seal WB by Solomon Colors, Inc. www.solomoncolors.com
 - b. Solvent-Based Acrylic Sealer: Film Forming, high gloss, color enhancement
 - i. Product: Brickform Gem Seal by Solomon Colors, Inc. www.solomoncolors.com
 - c. Solvent-Based Hybrid Penetrating Sealer: Low sheen, colorenhancement
 - i. Product: Brickform Gem Guard by Solomon Colors, Inc. www.solomoncolors.com
 - d. Water-Based Penetrating Sealer: Natural look with no sheen and no film

PART 3 - EXECUTION

3.01 GENERAL

- A Apply Materials in accordance with manufacturer's recommendations
- B Methods and materials shall match that of approved mockup production

3.02 CONCRETE FINISHING

- A Follow standard practices and reference Section 033000 B

Exposed Aggregate Finishing

1. Do not use tools that may force the aggregate away from the surface creating a non-uniform surface after exposure.
2. Finish slab surface to be uniform, flat, without low spots or ridges. Do not overwork the surface to be exposed.

3.03 COLLOIDAL SILICA SURFACE TREATMENT INSTALLATION

- A After screed and immediately before bull float for concrete performance application
 1. Spray-apply to concrete surface with uniform coverage
 2. Typical Coverage will be appx. 300-500 ft²/gallon
- B At time of troweling and/or hand finishing for finishing aid application
 1. Spray Apply as needed to facilitate finishing operations and surface lubrication
 2. Typical coverage will be 800-1000 ft²/gallon
- C Prevent overspray of material to adjacent equipment and construction materials.

3.04 CONCRETE SURFACE RETARDER INSTALLATION

- A Protect all adjacent concrete surfaces, pavers, stones, borders, etc. that are not to receive retarder finish prior to concrete placement and retarder application
- B Application
 1. Spray the Concrete Surface Retarder with low-pressure sprayer at a rate of 250- 300 ft²/gallon
 2. Maintain an even continuous application.
 3. Once dry, Concrete Surface Retarder will yield a coating that provides intermittent rain protection. Protect the surface if heavy extended rains are predicted or during extremely hot weather to retain moisture and protect the etch retention.
- C Removal
 1. Concrete Surface Retarder can be removed when the underlying concrete has sufficiently hardened, typically ranging from 5 to 12 hours after initial placement.
 2. Do not exceed 24 hours before removing
 3. Wash surface with running water with a push broom, high pressure washing, or a rotary buffer with bristle attachment and water.
 4. Timing and removal should be determined by the project testing and jobsite samples. When using light etches, it is generally better to remove Surface Retarder the same day.
 5. Dispose of wash water slurry in accordance with environmental regulations per relevant jurisdictional authority.

3.05 CONCRETE CURING and SEALING COMPOUND INSTALLATION

A Curing Compound [as determined]

1. After water from removal has dissipated from the slab, apply curing

compound uniformly.

2. Follow manufacturer's recommendations for coverage, methods, and environmental allowances.

B Sealer [as determined]

1. After recommended cure time has been achieved, apply surface sealer.
2. Follow manufacturer's recommendations for coverage, methods, and environmental allowances.

3.06 CONCRETE REPAIR AND PROTECTION

- A Repair and patch defective areas using the same materials as the original concrete.
Place, finish, and cure to achieve a blended appearance with adjacent concrete.
- B Remove and replace damaged areas that do not comply with requirements in this section.
Replacement areas should be made between joints or other visible termination point.
- C Protect finished concrete from staining, soils, and other foreign material until completion.
- D Follow recommended continuing maintenance procedures.

END OF SECTION

SECTION 040519 - MASONRY ANCHORAGE AND REINFORCING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Installation of masonry repair systems.
- B. Related Requirements
 - 1. Section 01 25 00- Substitution Procedures.
 - 2. Section 01 33 00- Submittal Procedures.
 - 3. Section 01 35 91- Historic Preservation Inspection Services
 - 4. Section 01 45 80- Testing Laboratory Services.
 - 5. Section 01 60 00- Product Requirements.
 - 6. Section 04 01 00- Maintenance of Masonry.
 - 7. Section 04 01 20.91- Unit Masonry Restoration.
 - 8. Section 04 01 40.91 Stone Restoration.
 - 9. Section 04 20 00- Unit Masonry.
 - 10. Section 04 26 13 – Masonry Veneer.

1.02 REFERENCES

- A. The date of the standard is that in effect as the date of receipt of bids for the project.
- B. The Masonry Society (TMS):
 - 1. TMS 402/602 Building Code Requirements and Specifications for Masonry Structures.
- C. ASTM International (ASTM):
 - 1. ASTM A 276/ 276M- Standard Specification for Stainless Steel Bars and Shapes.
 - 2. ASTM A580/580M – Standard Specification for Stainless Steel Wire.
 - 3. ASTM A582 – Standard Specification for Free-Machining Stainless Steel Bars.
 - 4. ASTM B16/16M – Standard Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines.
 - 5. ASTM C 1093- Standard Practice for Accreditation of Testing Agencies for Masonry.
- D. The Brick Industry Association (BIA):
 - 1. Tek Note #44b- Wall Ties for Brick Masonry.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Convene before the start of work on new concrete slabs, patching of existing concrete slabs and start of application of concrete finish system.
 - 1. Require attendance of parties directly affecting work of this Section, including the Owner's Representative, Contractor, Architect, Engineer, and Installer. Meeting should only convene when required parties are present.
 - 2. Review the following:
 - a. Installation procedure.
 - b. Quality control.

c. Coordination with other Work.

1.04 SUBMITTALS

A. Product Data:

1. Submit manufacturer's product data sheets and tested physical and performance properties for each product to be used, indicating the size and length of anchor to be used for the work.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer to be familiar with the specified requirements and the methods needed for proper installation of anchoring systems, including coordination with wall assembly components. Installer must have the proper equipment available to perform work within the scope of this project on a timely basis.

B. Manufacturer: Provide product design, product engineering, and technical assistance for the selection, application, and installation of an appropriate anchoring system for the project.

C. Testing Agency:

1. Field Testing: The inspector must be experienced with the proper use of calibrated test equipment.
2. Laboratory Testing: The testing agency must be qualified in accordance with ASTM C1093 for the testing indicated.

D. Mock-up: On-site, prior to the start of work within this section.

1. Require attendance of parties directly affecting work of this Section, including the Contractor, Installer, Architect, Engineer, and Owner's Representative.
2. Notify the above parties at least one week in advance of the date and time when the mock-up will be completed.
3. Install anchor for evaluation of application of workmanship
4. Perform in-situ testing of the installed anchors in the wall to be repaired to confirm the retrofit anchor performs as expected in both the veneer and backup independently.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in the mockups unless the Architect/Engineer specifically approves such deviations in writing.
6. Subject to compliance with requirements, an approved mockup may become part of the completed work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the worksite in manufacturer's original and unopened package, labeled with manufacturer's name and type of product.
- B. Store materials in an environment recommended on published manufacturer's product datasheets.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide [PROSOCO](https://www.prosoco.com/), Inc., (800) 255-4255, customercare@prosoco.com. Or one of the following.

1. Hohmann & Barnard, Inc. - Tel. 800.645.0616
2. Wire-Bond - Tel. 804.514.2648

B. Substitutions: In accordance with Section 012500 – Substitution Procedures.

2.02 ANCHORS AND TIES

- A. Mechanical expansion anchors: For veneers three inches or greater, provide a torque-activated anchor with components that expand in an umbrella shape, compressing against the base material to provide a positive connection.
1. Material:
 - a. Provide ties and anchors specified in this article that are made from materials that comply with the following, unless otherwise indicated.
 - 1) Stainless steel threaded rod: ASTM A276, Type [304][316].
 - 2) Brass: ASTM B16/16M, Type 360.
 2. Application:
 - a. Solid concrete backup conditions:
 - 1) 5000 Series Grip-Tie Anchors.
 - 2) 5000R Series Grip-Tie Anchors.
 - b. Hollow CMU backup conditions:
 - 1) 5100 Series Grip-Tie Anchors.
 - c. Structural steel backup conditions:
 - 1) Stitch-Tie 5200 Series Grip-Tie Anchors.
 - d. Stud (wood or steel) backup conditions:
 - 1) 5300 Series Grip-Tie Anchors.
- B. Thin panel veneer mechanical anchors: For veneers less than three inches thick, provide torque or hammer activated anchor with components that expand in an umbrella shape at the backup material, and a larger diameter anchor head for panel restraint. The panel anchors can be used for a load transfer of both gravity and lateral loading.
1. Material:
 - a. Provide ties and anchors specified in this article that are made from materials that comply with the following, unless otherwise indicated.
 - 1) Stainless steel threaded rod: ASTM A276, Type [304][316].
 - 2) Stainless steel rod: ASTM A582, Type 303.
 - 3) Brass: ASTM B16/16M, Type 360.
 2. Application:
 - a. Lateral only load transfer with solid concrete backup:
 - 1) 6000-1 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - 2) 6000-2 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - 3) 6000-2LD Series Stone-GripTie Anchors by PROSOCO, Inc.
 - b. Lateral only load transfer with hollow backup:
 - 1) 6100-1 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - 2) 6100-2 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - 3) 6100-2LD Series Stone-GripTie Anchors by PROSOCO, Inc.
 - c. Lateral only load transfer with structural steel or clay tile backup:
 - 1) 6200-1 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - 2) 6200-2 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - 3) 6200-2LD Series Stone-GripTie Anchors by PROSOCO, Inc.
 - d. Lateral only load transfer with structural metal or wood stud backup:
 - 1) 6300-1 Series Stone-GripTie Anchors by PROSOCO, Inc.

- 2) 6300-2LD Series Stone-GripTie Anchors by PROSOCO, Inc.
 - e. Gravity and lateral load transfer with solid backup
 - 1) 6500-3 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - 2) 6600-3 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - 3) 6800-3 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - f. Gravity and lateral load transfer with hollow backup
 - 1) 6500-3 Series Stone-GripTie Anchors by PROSOCO, Inc.
 - 2) 6600-3 Series Stone-GripTie Anchors by PROSOCO, Inc.
- C. Helical ties: Provide an in-plane flexible connection between wythes of material, while maintaining a threaded connection to resist out-of-plane loading for both tension and compression resistance.
- 1. Material:
 - a. Provide ties and anchors specified in this article that are made from materials that comply with the following, unless otherwise indicated.
 - 1) Stainless steel wire: ASTM A580/A580M, Type [304][316].
 - 2. Application:
 - a. Masonry veneer to solid concrete backup:
 - 1) Asymmetric Stitch-Tie by PROSOCO, Inc., [8mm][10mm] diameter.
 - 2) Stitch-Tie by PROSOCO, Inc., [8mm][10mm] diameter.
 - b. Masonry veneer to hollow CMU backup:
 - 1) Stitch-Tie by PROSOCO, Inc., [8mm][10mm] diameter.
 - c. Masonry Veneer to timber backup:
 - 1) Stitch-Tie by PROSOCO, Inc., [8mm][10mm] diameter.
 - d. Mass brick masonry:
 - 1) Stitch-Tie by PROSOCO, Inc., [8mm][10mm] diameter.
- D. Reinforced Grouted Helical Anchors: Provide stability to a masonry wall by filling voids in loose material by injecting thixotropic grout reinforced with a helical anchor.
- 1. Material:
 - a. Provide ties and anchors specified in this article that are made from materials that comply with the following, unless otherwise indicated.
 - 1) Stainless steel wire: ASTM A580/A580M, Type [304][316].
 - 2) Grout: BS EN 998-2.
 - 2. Anchor System
 - a. Grout-Tie by PROSOCO, Inc.
 - 1) 8mm Stitch-Ties by PROSOCO, Inc.
 - 2) SureGrout S (3900 psi / 27.5 Mpa) by Sure CPS.
- E. Injection grout sock anchors: Provide engineered sock anchors composed of an encapsulated reinforced stainless-steel core with injection grout to strengthen masonry and repair cracked or delaminated stone with minimal disruption.
- 1. Material:
 - a. Provide ties and anchors specified in this article that are made from materials that comply with the following, unless otherwise indicated.
 - 1) Stainless steel rod: ASTM A276, Type 304.
 - 2) Grout: BS EN 445, 446, 447, 196-1, and 196-3
 - 2. Anchor System
 - a. Heavy Duty Sock (HDS) Anchor by PROSOCO, Inc.
 - 1) HDS Anchor by PROSOCO, Inc.
 - 2) HDS Single component grout (9430 psi / 65 N/mm²) by PROSOCO, Inc.

- F. Horizontal Reinforcement: Provide supplemental joint reinforcement to reinforce cracked masonry and to create structural beams from existing brick veneers.
1. Material:
 - a. Provide ties and anchors specified in this article that are made from materials that comply with the following, unless otherwise indicated.
 - 1) Stainless steel wire: ASTM A580/A580M, Type [304][316].
 - 2) Grout: BS EN 998-2.
 2. Application:
 - a. Crack Stitching:
 - 1) Stitch-Tie Bar by PROSOCO, Inc., [4mm][6mm] diameter.
 - 2) Grout: SureGrout S (3900 psi / 27.5 Mpa) by Sure CPS.
 - b. Structural helical beam reinforcement:
 - 1) Stitch-Tie Bar by PROSOCO, Inc., 6mm diameter.
 - 2) Grout: SureGrout S (3900 psi / 27.5 Mpa) by Sure CPS.

2.03 EQUIPMENT

- A. Tools and Equipment:
1. Mechanical expansion anchors:
 - a. Hammer drill or SDS+ rotary hammer drill for solid material pilot holes.
 - b. Hammer drill for hollow or thin-shelled material pilot holes.
 - c. Drill bits, as required.
 - d. Appropriate setting tools per anchor variation as noted in the installation instructions.
 2. Thin panel veneer mechanical anchors:
 - a. Hammer drill or SDS+ rotary hammer drill for solid material pilot holes.
 - b. Hammer drill for hollow or thin-shelled material pilot holes.
 - c. Drill bits, as required.
 - d. Appropriate setting tools per anchor variation as noted in the installation instructions.
 3. Helical ties:
 - a. Hammer drill or SDS+ rotary hammer drill for solid material pilot holes.
 - b. Hammer drill for hollow or thin-shelled material pilot holes.
 - c. Drill bits, as required.
 - d. Setting tool with SDS+ chuck adapter for hammer only installation per the installation instructions.
 4. Reinforced grouted helical anchors:
 - a. Hammer drill or SDS+ rotary hammer drill for solid material pilot holes.
 - b. Hammer drill for hollow or thin-shelled material pilot holes.
 - c. Drill bits, as required.
 - d. Grout mixing paddle.
 - e. Grout gun.
 - f. Grout installation pinning nozzle with the grout gun adapter.
 5. Injection grout sock anchors:
 - a. Appropriate rotary hammer drill or rotary only core drill for the substrate.
 - b. Drill bits or core bits, as required.
 - c. Cement paddle mixing drill.
 - d. Mixing buckets, 5-gallon minimum.
 - e. HDS Anchor component kit (1 per anchor assembly).
 - f. HDS Grout Fill kit (minimum 1 per project).
 - g. Grout injection equipment for smaller projects:
 - 1) Battery-powered Albion grout gun, model DL-59-T13E.
 - 2) Albion nozzle adapter, model 966-1.
 - 3) Albion threaded front ring cap, model 421-G01.

- 4) PROSOCO Grout gun component kit, includes adapters and an in-line pressure gauge connecting the Albion DL-59-T13E to the PROSOCO HDS hose fitting.
- h. Grout injection equipment for larger projects:
 - 1) Pressure pot, 5-gallon, with a minimum outlet diameter of 1/2", 1/4 turn ball valve for feed control, and a pressure gauge for monitoring feet pressure
 - a. Recommended source that meets specifications: Void span 5 gallon pressure pot (<https://www.voidspan.com/product/5-gallon-pressure-pot/>)
 - 2) Air compressor, minimum 2 H.P.
 - 3) Additional plumbing fittings to adapt the pressure pot feed outlet to the 1/2" diameter PROSOCO HDS hose fitting.
6. Horizontal Reinforcement:
 - a. Angle Grinder.
 - b. Cement paddle mixing drill.
 - c. Manual lever grout gun.
 - d. Appropriate Trowel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting the performance of Work.
- B. Do not begin installation until unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.02 PREPARATION

- A. Clean dirt, dust, oil, grease, and other contaminants that interfere with penetration or performance of the specified product from surfaces.
- B. Locate anchors in the area to be anchored as indicated on the Drawings.
- C. Do not proceed until unsatisfactory conditions have been corrected.
- D. Install accessory products in accordance with the manufacturer's published recommendations and as noted on Drawings.

3.03 INSTALLATION

- A. Install anchor in accordance with manufacturer's published recommendations and mock-up.
- B. Mechanical expansion anchor installation:
 1. Select proper anchor length by field verification.
 2. Drill proper pilot hole size per the anchor type. See manufacturer's product data for recommendations.
 3. Blow out drill dust and debris from the pilot hole.
 4. Using the appropriate setting tool or adapter, install the anchor into the pre-drilled hole
 5. Using the appropriate setting tool or adapter, tighten the backup portion of the anchor to the recommended torque range.
 6. Using the appropriate setting tool or adapter, tighten the facade portion of the anchor to the recommended torque range.
 7. Conceal the anchor with the specified patching compound.
- C. Thin panel veneer mechanical anchors:
 1. Select proper anchor length by field verification.

2. Drill proper pilot hole size per the anchor type. See manufacturer's product data for recommendations.
3. Countersink hole in veneer if required. See manufacturer's product data for recommendations.
4. Blow out drill dust and debris from the pilot hole.
5. Using the appropriate setting tool or adapter, install the anchor into the pre-drilled hole
6. Using the appropriate setting tool or adapter, tighten the backup portion of the anchor to the recommended torque range.
7. Using the appropriate setting tool or adapter, install toggle if applicable.
8. Install the anchor head, washer, and gasket on the threaded shaft.
9. Conceal the anchor with the specified patching compound if countersunk.

D. Helical tie installation:

1. Select proper anchor length by field verification.
2. Drill proper pilot hole size per the anchor type. See manufacturer's product data for recommendations.
3. Install helical tie into the dry setting too mounted in an SDS drill.
4. Drive the helical tie anchor in the pilot hole and into the backup material.
5. The setting tool will recess the helical tie approximately 3/8 inch from the surface.
6. Conceal anchor with specified patching compound.
7. Space anchors in a staggered diamond pattern 16 inches on center vertically and 18 inches on center horizontally (1 Tie per 2 square feet). Install additional anchors within 8 inches of openings and discontinuities per BIA Technical note 44b.

E. Reinforced grouted helical anchor installation:

1. Select proper anchor length by field verification.
2. Drill proper pilot hole size per the anchor type. See manufacturer's product data for recommendations.
3. Clean the hole with water.
4. Prepare the helical anchor within the grout pinning nozzle.
5. Insert into the back of the drilled hole.
6. As the grout is injected, the helical anchor is carried with it.
7. Backpressure pushes the nozzle out of the hole to leave the full grouted tie in place.

F. Injection grout sock anchor installation:

1. Select proper anchor length by field verification.
2. Drill proper pilot hole size per the anchor type. See manufacturer's product data for recommendations.
3. Clean to ensure all debris is removed from the hole. Blow out drill dust and debris from the pilot hole.
4. Screw the blanking plug to the end of the sock anchor and install the anchor into the drilled hole, connecting the anchors to the desired length.
5. Attach the grout fill kit to the threaded end of the sock anchor.
6. Add the appropriate amount of water to the mixing bucket, limit water content to 6 to 7 liters maximum per 44 lb bag.
7. Add the appropriate amount of powder grout.
8. Mix the grout for a minimum of 2 minutes until a very fluid but creamy uniform consistency is attained. Always maintain the correct working ratio, as per the manufacturer's instructions.
9. Till the sock anchor using either the battery-operated grout gun or pressure pot with an air compressor. Limit the installation pressure to 44 psi.
10. Once the grout milk is seen running from the hole, stop the pumping and let it "relax" for a minimum of three minutes.

11. Clamp the pipe and remove the filling equipment.
12. Leave the exposed hose on the threaded sock anchor tube for two to three hours after installation prior to removal.
13. Patch the remaining hole with the specified patching compound, color-matched to the existing substrate.

G. Horizontal Reinforcement:

1. Grind away existing mortar, 20 inches minimum on each side of the crack, 1-1/2 inch to 2 inches deep.
2. Clean with water.
3. Apply a bead of the manufacturer's recommended grout.
4. Insert the helical tie bar into the bead of the manufacturer's recommended grout.
5. Apply a bead of grout over the helical tie bar.
6. If an additional helical tie bar is required, insert it into the bead of the manufacturer's recommended grout.
7. Apply a final bead of grout over the additional helical tie bar if required.
8. Compact with an appropriate trowel.

3.04 FIELD QUALITY CONTROL

- A. Site testing is encouraged for verification of helical or mechanical expansion anchor load capacity. Each construction site is unique and the appropriate use of this product is the responsibility of the engineers, architects, and other professionals who are familiar with the specific requirements of the project.
1. Testing Agency: [Owner will engage] [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. Re-testing of materials that fail to comply with specified requirements will be at the Contractor's expense.

END OF SECTION

SECTION 04 10 00 - MORTAR AND MASONRY GROUT FOR MASONRY**1. Part 1 - GENERAL****1.1. SECTION INCLUDES**

- A. Mortar for manufactured stone.

1.2. ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- B. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction

2. PART 2 – PRODUCTS**2.1. MATERIALS**

- A. Portland Cement: ASTM C150, Type I gray color.
- B. Premix Mortar: ASTM C387, using gray cement, Normal strength.
- C. Mortar Aggregate: ASTM C144, standard masonry type.
- D. Hydrated Lime: ASTM C207, Type N.
- E. Grout materials and proportions: ASTM C476.
- F. Water: Clean and potable.
- G. Waterproofing Admixture: W.R. Grace Co. “Dry Block”, application rate as recommended by manufacturer for each specific application.

2.2. MORTAR MIXES

- A. Ready Mixed Mortar: (optional) ASTM C1142, Type S.
- B. Mortar for Non-load Bearing Walls and Partitions: (optional) ASTM C270, Type S or Type N using the Property Method.
- C. Pointing Mortar for Masonry: (optional) ASTM C270, Type S or Type N using the Property Method; with maximum 2 percent ammonium stearate or calcium stearate per cement weight.

2.3. MORTAR MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.
- B. Add admixtures in accordance with manufacturer’s instructions.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.

2.4. MIX TESTS

- A. Test mortar and grout and submit laboratory report of 3 cube tests.
- B. Testing of Mortar Mix: In accordance with ASTM C780.

3. PART 3 – EXECUTION**3.1. EXAMINATION AND PREPARATION**

- A. Examine materials to be set and report irregularities to be corrected before beginning work.

3.2. INSTALLATION

- A. Install mortar in accordance with local code and standard practice.

3.3. SCHEDULES

- A. All masonry work = Type S mortar with Type S pointing mortar.

END OF SECTION 04 10 00

SECTION 04 20 00 UNIT MASONRY SYSTEM

1. PART 1 GENERAL

1.1. SECTION INCLUDES

- A. Concrete masonry and Brick units.
- B. Reinforcement, anchorage, and accessories.

1.2. PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 05 12 00 - Structural Steel: Structural Backing System.
- B. Section 05 12 00 - Structural Steel: Placement of steel anchors for steel beams.
- C. Section 05 21 00 - Steel Joists: Placement of steel bearing pads for joists.
- D. Section 05 50 00 - Metal Fabrications: Placement of loose steel lintels and fabricated steel items.
- E. Section 07 62 00 - Flashing and Sheet Metal: Placement of reglets for flashings.
- F. Division 16 - Electrical: Placement of electrical access boxes and light fixture lock boxes.

1.3. RELATED SECTIONS

- A. Section 01 45 00 - Quality Control: Testing Laboratory Services.
- B. Section 04 10 00 - Mortar and Masonry Grout: Mortar and grout.
- C.
- D. Section 05 50 00 - Metal Fabrications: Loose steel lintels and fabricated steel items.
- E. Section 07160 - Bituminous Damp-proofing: Damp-proofing [parged] masonry surfaces.] [tilt-up pre-cast concrete back-up walls].
- F. Section 07 19 10 - Vapor Retarders: Vapor retarder membrane placed [on interior face of wall insulation.
- G. Section 07 19 50 - Air Barriers: Air barrier placed [on interior face of wall insulation.
- H. Section 07 21 20 - Rigid Insulation: Insulation for cavity spaces.
- I. Section 07 21 40 - Foamed-in-Place Insulation: Insulation for masonry cores.
- J. Section 07 21 60 - Granular Insulation: Loose fill insulation for masonry [unit cores] [wall cavity].
- K. Section 07 62 00 - Sheet Metal Flashing and Trim: Cap flashings over masonry work [and placement of reglets for flashings].
- L. Section 07 84 00 - Fire-stopping: Fire-stopping at penetrations of masonry work.
- M. Section 07 90 00 - Joint Sealers: Rod and sealant at [control] [and] [expansion] joints.
- N. Section 09 90 00 - Painting: Water repellant coatings.

1.4. REFERENCES

- A. ACI 530 - Building Code Requirements for Masonry Structures.
- B. ACI 530.1 - Specifications For Masonry Structures.
- C. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.
- D. ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- F. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
- G. ASTM A580 - Stainless and Heat-Resisting Steel Wire.
- H. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- I. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.
- J. ASTM B370 - Copper Sheet and Strip for Building Construction.
- K. ASTM C34 - Structural Clay Load-Bearing Wall Tile.
- L. ASTM C55 - Concrete Building Brick.
- M. ASTM C56 - Structural Clay Non-Load Bearing Tile.
- N. ASTM C62 - Building Brick (Solid Masonry Units Made From Clay or Shale).
- O. ASTM C73 - Calcium Silicate Face Brick (Sand-Lime Brick).
- P. ASTM C90 - Load-Bearing Concrete Masonry Units.

- Q. ASTM C126 - Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
- R. ASTM C129 - Non-Load Bearing Concrete Masonry Units.
- S. ASTM C212 - Structural Clay Facing Tile.
- T. ASTM C216 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
- U. ASTM C315 - Clay Flue Linings.
- V. ASTM C530 - Structural Clay Non-Load Bearing Screen Tile.
- W. ASTM C652 - Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
- X. ASTM C744 - Pre-faced Concrete and Calcium Silicate Masonry Units.
- Y. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
- Z. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Hot Weather Masonry Construction.
- AA. UL - Fire Resistance Directory.

1.5. SUBMITTALS

- A. Submit under provisions of Section 01300.
 - 1. Allow for masonry supplier product delivery requirements.
- B. Product Data: Provide data for each decorative, pre-faced masonry unit required and required reinforcement, anchorage, flashings and accessories.
- C. Samples: Submit four samples of each size, texture and color of decorative block, face brick, and pre-faced units selected to illustrate color, texture and extremes of color range.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6. QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.7. QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8. REGULATORY REQUIREMENTS

- A. N/A

1.9. FIELD SAMPLE

- A. Provide field samples of face brick and concrete masonry units under provisions of Section 01 40 00. Provide as many field sample panels as required for acceptance by Owner and Architect.
- B. Construct a masonry wall into a panel sized [8] feet wide by [6] feet high, which includes mortar and accessories, wall openings, and flashings.
- C. Contractor must provide samples of insulated exterior glass unit and aluminum window wall framing section before brick wall field sample will be reviewed.
- D. Field Sample will be used for review of mortar color and joint sealant field samples.
- E. Locate where directed.
- F. Use field sample to test proposed cleaning procedures.
- G. Field sample may not remain as part of the Work. Do not destroy or remove until directed by Architect.

1.10. PRE-INSTALLATION CONFERENCE

- A. Convene one week prior to commencing work of this section, including field samples under provisions of Section 01039.

1.11. DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.

- B. Accept glazed, pre-faced, face brick masonry, split face, and burnished CMU units on site. Inspect for damage.
- C. Provide protection which will limit moisture absorption of concrete masonry units to the maximum percentage specified for Type I units at a relative humidity that is normal for the project site.

1.12. ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Hot Weather Requirements: Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

1.13. PROJECT CONDITIONS

- A. Construction Protection: Cover tops of incomplete masonry elements with waterproof sheet material at the end of each workday and when masonry work is not underway.
 - 1. Secure weather protection in place with weights or by use of temporary fasteners.
 - 2. Immediately remove mortar, soil and other such materials from exposed masonry faces to prevent staining.
 - 3. Prevent splashing and soiling of masonry near ground level by spreading sheet material top over soil or masonry faces.
 - 4. Protect horizontal masonry elements from mortar droppings.
- B. Loading Protection: Do not apply uniform floor or roof loads for at least 12 hours or concentrated loads for at least 3 days after completion of masonry elements.

1.14. COORDINATION

- A. Coordinate work under provisions of Section 01039.
- B. Coordinate the masonry work with installation of window anchors, decorative steel fabrications and electrical control boxes and light fixtures.

1.15. EXTRA MATERIALS

- A. Submit under provisions of Section 01700.
- B. Provide 10 of each size, color, and type of glazed and pre-faced and manufactured stone units.

2. PART 2 PRODUCTS

2.1. MANUFACTURERS - CONCRETE MASONRY UNITS

- A. Featherlite; Product: Burnished Masonry Units.
- B. TXI; Product: Burnished Masonry Units.
- C. Featherlite; Product: Limestone Smooth Masonry Units.
- D. TXI; Product: Limestone Smooth Masonry Units.
- E. Arriscraft International, Inc. Lombard, SL. (Texas Contact - Blackson Brick Co. Dallas, TX).
- F. Substitutions: Under provisions of Section 01600.

2.2. CONCRETE MASONRY UNITS

- A. Integral Water Repellent: Provide units made with liquid polymeric, integral water repellent admixture that does not reduce flexural bond strength for exposed exterior units.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ACM Chemistries, Inc.; RainBloc.
 - b. BASF Aktiengesellschaft; Rheopel Plus.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.
- B. Hollow Load Bearing Block Units (CMU): ASTM C90, Type I - Moisture Controlled; normal weight. See drawings for CMU sizes.

C. Decorative CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
2. Density Classification: Lightweight.
3. Pattern and Texture:
 - a. Scored vertically, split-face finish. Match existing patterns and colors.
 - b. Burnished Face Finish where shown on drawings.

2.3. CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Block Units (CMU): ASTM C90, Type I - Moisture Controlled; normal weight.

2.4. BRICK UNITS

- A. Face brick shall match existing & be approved by owner and architect. Masonry contractor shall use running bond and English bond where shown on drawings.

2.5. REINFORCEMENT AND ANCHORAGE

- A. Joint Reinforcement: Welded-wire units prefabricated into straight lengths on not less than 10 feet, with deformed continuous side rods, plain cross rods, and as follows:
 1. Width: Approximately two inches less than nominal wall width, providing not less than 5/8 inch mortar coverage on exterior exposures and 1/2 inch elsewhere.
 2. Wire Sizes:
 - a. Side rod diameter: 3/16 inch.
 - b. Cross rod diameter: 9 gauge.
 3. Configuration:
 - a. Single Wythe Joint Reinforcement: Truss or Ladder type; steel wire, hot dip galvanized to ASTM A153 Class B-2 after fabrication, cross ties at not more than 16 inches on center.
 - i. Multiple Wythe Joint Reinforcement: Ladder type; with moisture drip; [adjustable type,] steel wire, hot dip galvanized to ASTM A153 Class B-2 after fabrication. Cross ties at not more than 16 inches on center. Use units with adjustable U-shaped tabs where horizontal joints of backup do not align with those of facing masonry.
 - ii. Corners: Prefabricated L-shaped and T-shaped units.

2.6. MORTAR AND GROUT

- A. Mortar and Grout: As specified in Section 04 10 00.

2.7. FLASHINGS

- A. Thin Wall Flashing: Self-adhesive, 40 mil thick, laminated polyethylene/rubberized asphalt flashing.
 1. Product: Textroflash Flashing as manufactured by Hohmann & Barnard, Inc.
 - a. Size: Width as required.

2.8. ACCESSORIES

- A. Preformed Control Joints: ASTM D2000, Styrene-butadiene rubber compound; Designation 2AA-805. Provide with corner and tee accessories, cement fused joints.
- B. Expansion Joint Strips: Neoprene filler strips complying with ASTM D1056, Grade RE41, capable of 35 percent compression and sized for specific conditions indicated.
- C. Bond Breaker Strips: ASTM D226, Type I; No. 15 asphalt felt.
- D. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self expanding; width 1/4 inch less than masonry thickness by maximum lengths.
- E. Building Paper: No. 15 asphalt saturated felt.
- F. Wall Cavity Drainage Fill (mortar dropping collection device): High-density polyethylene or nylon open mesh in a dovetail shape. 90% open mesh construction manufactured in a dovetail shape.

1. Product: MortarNet as manufactured by Hohmann & Barnard, Inc.
2. Size: [2] [1] inch[es] thick.
- G. Weeps: [Preformed plastic tubes, hollow.] [Provide open head joints.]
 1. Product: QV-Quadro-Vent as manufactured by Hohmann & Barnard, Inc.
- H. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials. As recommended by masonry manufacturer.

3. PART 3 EXECUTION

3.1. EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2. PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other sections.
- B. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, expansion and control joints returns and offsets. Do not use units less than half size at corners and jambs.
- C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- D. Brick: Before laying, wet brick with initial absorption rate of more than 1 gram per square inch per minute, when measured in accordance with ASTM C67, using technique that will saturate brick but leave it dry to the touch.
- E. Concrete Masonry Units: Do not wet concrete units prior to laying.

3.3. COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 1. Bond: Running
 2. Coursing: One unit and one mortar joint to equal 8 inches
 3. Mortar Joints: Concave except flush in cavities of double width masonry walls and behind resilient base.
- D. Brick Units:
 1. Bond: Running, match existing and English Bond where shown on drawings.
 2. Coursing: Three units and three mortar joints to equal 8 inches.
 3. Mortar Joints: Concave.

3.4. PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- D. Remove excess mortar as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, un-chipped edges. Prevent broken masonry unit corners or edges. Cut units as required to provide pattern shown and fit adjoining work neatly.

- H. Cut mortar joints flush where wall tile is scheduled, [cement parging is required,] [resilient base is scheduled,] [cavity insulation vapor barrier adhesive is applied,] [or] [bitumen damp-proofing is applied].
- I. Isolate masonry partitions from vertical structural framing members with a control joint.
- J. Isolate top joint of non-load bearing masonry partition walls from horizontal structural framing members and slabs or decks with compressible joint filler.
- K. Stopping and Resuming Work: Rack back 1/2 unit length in each course, do not tooth. Clean exposed surfaces of set masonry and remove loose masonry.

3.5. WEEPS

- A. Install weeps in veneer at 32 inches o.c. horizontally above through-wall flashing, at bottom of walls and near top of walls for vapor pressure relief.

3.6. CAVITY WALL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Maintain clean dimension of air space indicated on drawings.
- B. Install mortar dropping collection device as specified at all weep hole locations. Install at base of veneer wall cavities, above thru-wall flashing.
- C. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor barrier adhesive.

3.7. REINFORCEMENT AND ANCHORAGE - SINGLE WYTHER MASONRY

- A. Install horizontal joint reinforcement 16 inches o.c.
- B. Install horizontal joint reinforcement 8 inches o.c. in parapets.
- C. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- D. Place joint reinforcement continuous in first and second joint below top of walls.
- E. Lap joint reinforcement ends minimum 6 inches.
- F. Reinforce [stack bonded unit] joint corners and intersections with anchors 16 inches o.c.

3.8. REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches o.c.
- B. Install horizontal joint reinforcement 8 inches o.c. in parapets.
- C. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- D. Place joint reinforcement continuous in first and second joint below top of walls.
- E. Lap joint reinforcement ends minimum 6 inches.
- F. Anchor masonry veneer to structural backup with anchors specified, and as follows:
 - 1. Fasten to backup with self-taping, non-corrosive fasteners as recommended by manufacturer of anchors for substrate conditions.
 - 2. Embed tie sections in mortar as masonry is being laid, providing clear air space of at least [2] inches behind veneer wythe.
 - 3. Space anchor plates to be centered on horizontal mortar joints, allowing maximum vertical movement of ties due to differential movement of veneer and backup.
 - 4. Space anchors at not more than 1.77 square feet per anchor, no more than 16 inches on center horizontally and vertically. At openings and ends of veneer panels, provide additional anchorage so that maximum spacing at perimeter is 8 inches or less.
 - 5. Do not field bend galvanized embedded materials. Apply touch-up galvanized paint at all damaged sections.
- G. Anchor masonry veneer to masonry back-up with anchors specified, and as follows:
 - 1. Embed wall ties in masonry back-up to bond veneer at maximum 16 inches o.c. vertically and 24 inches o.c. horizontally. Place at maximum 16 inches o.c. each way around perimeter of openings, within 12 inches of openings.

- H. Reinforce [stack bonded unit] joint corners and intersections with anchors 16 inches o.c.

3.9. REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

- A. Install horizontal joint reinforcement 16 inches o.c.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place joint reinforcement continuous in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. [Embed dovetail anchors in concrete.] [Attach to structural steel members.] Embed anchorages in every [second block] [sixth brick] joint.
- F. Reinforce [stack bonded unit] joint corners and intersections with anchors 16 inches o.c.

3.10. REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

- A. Install horizontal joint reinforcement 16 inches o.c.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place joint reinforcement continuous in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- F. Embed anchors . Embed anchorages in every second block joint.

3.11. INSTALLING CONCEALED MASONRY FLASHINGS

- A. General: Whether or not specifically indicated, install flashing at all conditions such as lintels and shelf angles, where the downward flow of water within the masonry will be interrupted, so that such water will be diverted to the exterior. Extend flashings full width at such obstructions and at least 4 inches into adjoining masonry, or turn up to form watertight pan at non-masonry construction. Remove or cover protrusions or shape edges on substrates which could puncture flashings. Place flashings on sloped mortar bed; seal lapped ends and penetrations of flashing before covering with mortar.
 - 1. Extend metal flashings through exterior face of masonry and turn down to form drip.
 - 2. Extend fabric of laminated flashings to within 1/4 inch of exterior face of masonry.
- B. Through-wall Flashings: Bring completely through inner wythe and turn up where concealed by other construction; otherwise stop not more than 1/2 inch from inner face. Drop flashing at least 4 inches before bringing through outer wythe.
- C. Veneer Flashings: Turn flashings up not less than 4 inches at backup and minimum 6 inches above wall cavity drainage fill. Lap top of flashing with building paper or otherwise seal to prevent moisture penetration between flashing and backup.
- D. Head and Sills: Turn up ends of flashing At least 2 inches At heads and sills to form pan, and seal joints.
- E. Sealing: Seal all joints in flashing to assure watertight integrity.
 - 1. Lap end joint on non-deformed metal flashings at least 4 inches; seal laps with elastic sealant or mastic.
 - 2. Lap end joints of flexible flashings at least 4 inches; seal in accordance with manufacturers instructions.
- F. Fill cavity above concealed flashings with wall cavity drainage fill.
- G. Weep Holes: Provide weep holes in head joints of the first course of masonry immediately above concealed flashings. Space at intervals of 24 inches on center.
- H. Reglets and Other Accessories: Install to receive flashing where indicated.

3.12. LINTELS

- A. Install loose steel lintels over openings.

- B. Install reinforced unit masonry lintels over openings where steel or pre-cast concrete lintels are not scheduled.
 - 1. Openings Up To 42 inches Wide: Place two, No. 5 reinforcing bars 1 inch from bottom web.
 - 2. Openings Over 42 inches: Reinforce openings as detailed. Do not splice reinforcing bars.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. Allow masonry lintels to attain specified strength before removing temporary supports.
- F. Maintain minimum 8 inch bearing on each side of opening.

3.13. CUTTING AND FITTING

- A. Cut and fit for pipes, conduit and sleeves. Coordinate with other sections of work to provide correct size, shape and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14. GROUTED COMPONENTS

- A. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- B. Place and consolidate grout fill without displacing reinforcing.
- C. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.15. ENGINEERED MASONRY

- A. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
- B. Place mortar in masonry unit bed joints back 1/4 inch from edge of unit grout spaces, bevel back and upward. Permit mortar to cure 7 days before placing grout.
- C. Reinforce masonry unit cores and cavities with reinforcement bars and grout as indicated.
- D. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcement in accordance with Section 03200.
- E. Wet masonry unit surfaces in contact with grout just prior to grout placement.
- F. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout spaces 2 inches or greater in width with course grout using high or low lift grouting techniques.
- G. When grouting is stopped for more than one hour, terminate grout [1-1/2] inch below top of upper masonry unit to form a positive key for subsequent grout placement.
- H. Low Lift Grouting: Place first lift of grout to a height of 16 inches to three CMU courses and rod for grout consolidation. Place subsequent lifts in 8 inch increments and rod for grout consolidation.
- I. High Lift Grouting:
 - 1. Provide cleanout opening no less than 4 inches high at the bottom of each cell to be grouted by cutting one face shell of masonry unit.
 - 2. In double wythe walls, omit every second masonry unit in one of the wythes for clean out and cell inspection purposes.
 - 3. In double wythe walls, construct vertical grout barriers or dams between the masonry wythes, with masonry units every 30 feet maximum.
 - 4. Clean out masonry cells and cavities with high pressure water spray. Permit complete water drainage. Remove debris.
 - 5. Request inspection of the cells and cavities. Allow 3 days advance notice of inspection.
 - 6. After cleaning and cell inspection, seal openings with masonry units.
 - 7. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.
 - 8. Limit grout lift to 60 inches and rod for grout consolidation. Wait 30 to 60 minutes before placing next lift.

3.16. CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control and expansion joints
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Size control joint in accordance with Section 07900 for sealant performance.
- D. Form expansion joint as detailed.

3.17. BUILT-IN WORK

- A. As work progresses, install built-in metal door and glazed frames, metal fabrications, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and electrical lock boxes and other items to be built-in the work and furnished by other sections.
- B. Install built-in items plumb and level.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum [12] inches from framed openings.
- D. Do not build in organic materials subject to deterioration.

3.18. TOLERANCES

- A. Maximum Variation From Alignment of Pilasters: $\frac{1}{4}$ inch.
- B. Maximum Variation From Unit to Adjacent Unit: $\frac{1}{16}$ inch.
- C. Maximum Variation from Plane of Wall: $\frac{1}{4}$ inch in 10 ft. and $\frac{1}{2}$ inch in 20 ft. or more.
- D. Maximum Variation from Plumb: $\frac{1}{4}$ inch per story non-cumulative; $\frac{1}{2}$ inch in two stories or more.
- E. Maximum Variation from Level Coursing: $\frac{1}{8}$ inch in 3 ft. and $\frac{1}{4}$ inch in 10 ft.; $\frac{1}{2}$ inch in 30 ft.
- F. Maximum Variation of Joint Thickness: $[\frac{1}{8}]$ inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: $[\frac{1}{4}]$.

3.19. FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 40 00.
- B. Inspect and test all masonry work.
- C. Inspect and test engineered masonry work.
- D. Inspect and test parging work.

3.20. CLEANING

- A. Clean work under provisions of 01 70 00.
- B. Remove excess mortar and mortar smears as work progresses. Dry brush at end of each day's work.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with cleaning solution recommended by masonry manufacturer.
- E. Use non-metallic tools in cleaning operations.
- F. The use of sealers of any kind is prohibited. This will void the manufacturers lifetime warranty.

3.21. PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01 50 00.
- B. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.
- C. Remove protection when risk of damage is no longer present and without damage to masonry.

END OF SECTION 042000

SECTION 042113 - BRICK MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
- B. Face brick – Match existing face brick. Verify at job site.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: Provided samples for each type and color of brick and colored mortar.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product indicated.

1.4 QUALITY ASSURANCE

- A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- B. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
 - 1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches by full thickness. No other masonry shall be laid until this has been approved by the Architect.

1.5 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 BRICK

- A. General: Provide shapes indicated and as follows.
1. **For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.**
 2. **Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.**
- B. Face Brick (closed specification): Facing brick complying with ASTM C 216.
1. Provide Acme Brick – Golden Sunset to match the existing brick on the School of Construction Practice Lab Building, University of Louisiana Monroe. This is a closed specification for the purpose of maintaining a uniform appearance with the existing building. No substitutions will be permitted.
 2. Manufacturer: Acme Brick
 3. Product: Golden Sunset
 4. Grade: SW
 5. Type: FBS
 6. Size: match existing onsite; verify dimensions at job site
 7. Shapes: provide special shapes as required for maintain the existing façade pattern
 8. Color & texture: golden sunset velour – match existing construction exactly

MORTAR MATERIALS

- C. Masonry Cement: ASTM C 91, Type N.
1. Products: Subject to compliance with requirements, provide products by one of the following:
 - a. Cemex S.A.B. de C.V.
 - b. Holcim (US) Inc.
 - c. Lafarge North America Inc.
 - d. Lehigh Cement Company.
 - e. National Cement Company, Inc.

- D. Aggregate for Mortar: ASTM C 144; Natural sand or crushed stone.
- E. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn; Morset.
 - c. Sonneborn Products; Trimix-NCA.

2.3 REINFORCEMENT

- A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
- B. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch diameter, hot-dip galvanized, carbon-steel continuous wire.

2.4 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized steel wire.
 - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch diameter, hot-dip galvanized steel wire.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch thick, steel sheet, galvanized after fabrication.
 - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch diameter, hot-dip galvanized steel wire.

3. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.060-inch thick, steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch of masonry face.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Screw-Attached, Masonry-Veneer Anchors: Thermal-Grip MVA – Anchors masonry with minimal thermal bridging.
 - a. Basis Of Design products: Provide Prosoco Thermal-Grip MVA masonry anchor or provide products by one of the following.
 - 1) Dayton Superior Corporation, Dur-O-Wal Division.
 - 2) Heckmann Building Products, Inc.
 - 3) Hohmann & Barnard, Inc.
 - b. Anchor Section: Barrel: Sabic Lexan 143 Polycarbonate. Wire Tie: ASTM A580 Stainless Steel 304, Tensile 102,500 – 150,000, Yield 70,000 psi. Washer is Polypropylene with carbon black UV stabilizer. Screw is ASTM A510 Carbon Steel. Screw Pull Out Values CMU Block: 476 lbs. Wood: 662 lbs. 18ga: 694 lbs. 16 ga: 896 lbs.

2.5 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual," Section 076200 "Sheet Metal Flashing and Trim" and as follows:
1. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 2. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.
 - a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Advanced Building Products Inc; Strip-N-Flash.
 - 2) Carlisle Coatings & Waterproofing Inc; CCW-705-TWF Thru-Wall Flashing.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier Thru-Wall Flashing.
 - 4) Grace Construction Products; W.R. Grace & Co. -- Conn; Perm-A-Barrier Wall Flashing.
 - 5) Heckmann Building Products, Inc; No. 82 Rubberized-Asphalt Thru-Wall Flashing..
 - 6) Hohmann & Barnard, Inc; Textroflash.
 - 7) Meadows, W.R.,Inc; Air-Shield Thru-Wall Flashing.
 - 8) Williams Products, Inc; Everlastic MF-40.
 - 9) Termination Bar: Install as needed at wall flashing by each manufacture listed above.
2. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch thick.
- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc; Pre-Kleened EPDM Thru-Wall Flashing.
 - 2) Firestone Specialty Products; FlashGuard.
 - 3) Heckmann Building Products, Inc; No. 81 EPDM Thru-Wall Flashing..
 - 4) Hohmann & Barnard, Inc; Epra-Max EPDM Thru-Wall Flashing.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
- D. 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.
- 2.6 MISCELLANEOUS MASONRY ACCESSORIES
- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- C. Weep/Vent Products:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc; Mortar Maze weep vent.

- 2) BLOK-LOK Limited; Cell-Vent.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 4) Heckmann Building Products, Inc; No. 85 Cell Vent..
 - 5) Hohmann & Barnard, Inc; Quadro-Vent.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Building Products Inc; Mortar Break.
 - b. CavClear/Archovations, Inc; Stone Mat.
 - c. Dayton Superior Corporation, Dur-O-Wal Division; Polytime MortarStop.
 - d. Mortar Net USA, Ltd; Mortar Net.
 2. Provide the following configuration:
 - a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep.

2.7 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. PROSOCO, Inc.

2.8 MORTAR 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.
 2. Use masonry cement mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. 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.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
 - 5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
- 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; do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 2. 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.

3.3 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. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.6 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 32 inches o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.7 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 3. 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.
 4. 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 head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 1. Use specified weep/vent products to form weep holes.
 2. Space weep holes 24 inches o.c. unless otherwise indicated.
- D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.8 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: Level 1 special inspections according to the "International Building Code."
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

3.9 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes
 - 2. Protect adjacent surfaces from contact with cleaner.
 - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 4. Clean brick by bucket-and-brush hand-cleaning method described in "BIA Technical Notes 20."
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.10 MASONRY WASTE DISPOSAL

- A. 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. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042113

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Pre-faced concrete masonry units.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.
10. Masonry-cell insulation.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing dovetail slots for masonry anchors.
2. Division 05 Section "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural-steel frame.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
 2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 3. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
 4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
1. Decorative CMUs, in the form of small-scale units.
 2. Pre-faced CMUs.
 3. Colored mortar.
 4. Weep holes/vents.
- D. Samples for Verification: For each type and color of the following:
1. Exposed CMUs.
 2. Pre-faced CMUs.
 3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 4. Accessories embedded in masonry.

- E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- F. Qualification Data: For testing agency.
- G. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
 - 6. Joint reinforcement.
 - 7. Anchors, ties, and metal accessories.
- H. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- I. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- J. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.8 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 designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and 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.

1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
- C. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of as indicated.

2. Density Classification: Lightweight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.3 MASONRY LINTELS

- A. General: Provide one of the following:
- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Provide aggregate for mortar and grout[, cement, and lime] that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- E. Masonry Cement: ASTM C 91.
- F. Aggregate for Mortar: ASTM C 144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs, containing integral water repellent by same manufacturer.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ACM Chemistries, Inc.; RainBloc for Mortar.
 - b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
- J. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel.
 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch- diameter, hot-dip galvanized steel.

- C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick, steel sheet, galvanized after fabrication.
 - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.25-inch- diameter, hot-dip galvanized steel.
 - 3. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from [0.060-inch- thick, steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete and sized to extend to within 1 inch of masonry face.
- D. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 28 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated bent to configuration indicated.
 - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.7 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.
- C. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- D. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
 - 3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Division 07 Section "Sheet Metal Flashing and Trim" and as follows:

1. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 3. Fabricate through-wall metal flashing embedded in masonry from copper, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
 4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 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.
 6. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
 7. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
 8. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 9. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
 10. Metal Expansion-Joint Strips: Fabricate from copper to shapes indicated.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Advanced Building Products Inc.; Copper Fabric Flashing.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
 - 3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
 - 4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
 - 5) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
 - 6) York Manufacturing, Inc.; Multi-Flash 500.
- C. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.

4. Where flashing is fully concealed, use metal flashing.
- D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.
- E. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."
 1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 3. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
 - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 MASONRY-CELL INSULATION

- A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
- B. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Concrete Block Insulating Systems; Korfil.
 - b. Shelter Enterprises Inc.; Omni Core.

2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime, masonry cement, or mortar cement mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime, masonry cement, or mortar cement mortar.
 - 4. For reinforced masonry, use portland cement-lime, masonry cement, or mortar cement mortar.
 - 5. 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 C 270, Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S.
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.

- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

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 work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
- 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. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. 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.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.

2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

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 bond pattern indicated on Drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Allow cleaned surfaces to dry before setting.
 3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to one story high, but not more than 20 feet.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
1. Provide an open space not less than 1/2 inchwide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.10 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 FLASHING

- A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, 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 lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.

4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
 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.
 7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- 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 other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/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 ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to

perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

- B. Inspections: Level 1 special inspections according to the "International Building Code."
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.14 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.15 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 concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.16 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 Division 31 Section "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 047200 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast stone trim, caps, sills and water-tables.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include dimensions and finishes.
- B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
- C. Samples:
 1. For each color and texture of cast stone required.
 2. For colored mortar.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute and/or the Architectural Precast Association.

PART 2 - PRODUCTS

2.1 CAST STONE UNITS

- A. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
 1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

2. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
3. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
4. Provide drips on projecting elements unless otherwise indicated.

B. Cure units as follows:

1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:
 - a. No fewer than five days at mean daily temperature of 70 deg F or above.
 - b. No fewer than six days at mean daily temperature of 60 deg F or above.

C. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

D. Colors and Textures: As selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.
- B. Dowels: 1/2-inch diameter, round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.
- C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner, expressly approved for intended use, by cast stone manufacturer and cleaner manufacturer.

2.3 MORTAR

- A. Comply with requirements in Section 042000 "Unit Masonry" for mortar materials and mixes.
 1. For setting mortar, use Type N.
 2. For pointing mortar, use Type N.
 3. Pigmented Mortar: Use colored cement product complying with Section 042200 "Concrete Unit Masonry."

PART 3 - EXECUTION

3.1 SETTING CAST STONE IN MORTAR

- A. Install cast stone units to comply with requirements in Section 042200 "Concrete Unit Masonry."
- B. Set units in full bed of mortar with full head joints unless otherwise indicated.
 1. Fill dowel holes and anchor slots with mortar.
 2. Fill collar joints solid as units are set.

3. Build concealed flashing into mortar joints as units are set.
 4. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
 5. Keep joints at shelf angles open to receive sealant.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Provide sealant joints at copings and other horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated.
1. Keep joints free of mortar and other rigid materials.
 2. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.2 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

- A. Set units accurately in locations indicated with edges and faces aligned.
1. Install anchors, supports, fasteners, and other attachments to secure units in place.
 2. Shim and adjust anchors, supports, and accessories.
- B. Fill anchor holes with sealant.
1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
- C. Set cast stone supported on clip or continuous angles on resilient setting shims. Hold shims back from face of cast stone a distance at least equal to width of joint.
- D. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored.
- E. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean cast stone as work progresses.
 - 1. Remove mortar fins and smears before tooling joints.
 - 2. Remove excess sealant immediately, including spills, smears, and spatter.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone according to manufacturer's recommendations.

END OF SECTION 047200

SECTION 05 12 00 - STRUCTURAL STEEL**1. PART 1 GENERAL****1.1. DESCRIPTION**

- A. Perform all work required to complete the Structural Steel work indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.

1.2. RELATED WORK SPECIFIED ELSEWHERE

- A. Test and Laboratory Control - Section 01 45 00.
- B. Metal Decking - Section 05 31 00.

1.3. REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
- D. ASTM A153-Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- F. ASTM A307-Carbon Steel Externally Threaded Standard Fasteners.
- G. ASTM A325-High Strength Bolts for Structural Steel Joints.
- H. ASTM A386-Zinc-Coating (Hot-Dip) on Assembled Steel Products.
- I. ASTM A500-Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- J. ASTM A501-Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- K. ASTM B177-Chromium Electroplating on Steel for Engineering Use.
- L. AWS A2.0-Standard Welding Symbols.
- M. AWS D1.1-Structural Welding Code.
- N. SSPC - Steel Structures Painting Council..

1.4. QUALITY ASSURANCE

- A. The testing laboratory approved by the Architect and Engineer shall inspect high-strength bolted connections and welds and perform all tests in the shop and in the field and submit test reports to the Architect as hereinafter specified. The testing laboratory shall be responsible for conducting and interpreting the test, shall state in each report whether or not test specimens conform to all requirements of the Contract Documents, and shall specifically note any deviations therefrom. Corrective measures, including additional testing, which result from these tests shall be the Contractor's responsibility.
- B. The testing agency shall furnish to the Architect five (5) certified copies of all test reports.

1.5. REQUIREMENTS OF REGULATORY AGENCIES

- A. Building Code shall mean 2021 International Building Code.
- B. AISC Specifications for Structural Steel shall mean ANSI/AISC 360-10 Specification for Structural Steel Buildings, June 22, 2010.
- C. Specification for Structural Joints shall mean Specification for Structural Joints using High-Strength Bolts approved by the Research Council on Structural Connections of the Engineering Foundation, December 31, 2009.
- D. AWS Building Code shall mean AWS "Code for Welding in Building Construction," latest edition.

- E. ASTM shall mean the appropriate specification of the American Society of Testing and Materials.

1.6. QUALIFICATIONS

- A. Steel Fabricator: Fabricator shall have not less than 10 years experience in the fabrication of structural steel.
- B. Steel Erector: Erector shall have not less than 10 years experience in the erection of Structural steel.
- C. Welding procedures, welders, welding operations and tackers shall be qualified in accordance with the AWS Building Code. Certification of welders by the testing laboratory shall not be more than six months old at the time of welding in the erection period.

1.7. SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Meet requirements of applicable portions of "Structural Shop Drafting" by AISC.
- C. Shop Drawings:
 - 1. Submit shop drawings, indicating all shop and erection details, including cuts, copes, connections, holes, threaded fasteners, rivets, and welds.
 - 2. All welds, both shop and field, shall be indicated by AWS Welding Symbols. Indicate net weld lengths.
 - 3. Shop drawings shall not be made by using reproductions of contract drawings.
 - 4. Any fabrication of material before approval of drawings will be at the risk of the Contractor.
 - 5. Note and mark sufficiently to indicate compliance with requirements of these specifications.
- D. Erection Procedure: Submit descriptive data to illustrate the structural steel erection procedure, including sequence of erection and temporary staying and bracing.
- E. Welding Procedure: Submit qualification of flux-cored arc welding procedures in accordance with Article 502, AWS D1-1.
- F. Welders Certificates: Submit under provisions of Section 01300, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
- G. Proof of Compliance for Materials:
 - 1. Report of ladle analysis of all steel.
 - 2. Report of tensile properties for:
 - a. Steel shapes
 - b. Steel bars
 - c. Steel plates
 - 3. Mill Certifications.

1.8. PROPOSED SUBSTITUTIONS

- A. Substitutions of sections or modification of details, if proposed by the Contractor, shall be submitted for approval in sketch form prior to submission of shop drawings, and such substitutions shall be made only when approved by the Architect and Engineer.

1.9. PRODUCT HANDLING

- A. Delivery of materials to be installed under other sections.
 - 1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete or masonry construction shall be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
 - 2. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.
 - 3. The General Contractor shall check the correct positioning of anchor bolts before concrete is placed. Subsequent displacement of the anchor bolts will be the responsibility of the General Contractor.
- B. Storage of materials.
 - 1. Structural steel members which are stored at the project site shall be above ground on platforms, skids, or other supports.
 - 2. Steel shall be protected from corrosion.
 - 3. Other materials shall be stored in a weather-tight and dry place, until ready for use in the work.
 - 4. Packaged material shall be stored in their original unbroken package or container.

2. PART 2 PRODUCTS

2.1. MATERIALS

- A. Steel Wide Flange Shapes: ASTM A992-50
- B. Steel, Shapes, Bars and Plates other than wide flanges ASM A36 or ASTM A992
- C. Headed Stud Type Shear Connectors:
 - 1. Cold finished carbon steel, ASTM A108.
 - 2. Dimensions of shear connectors shall conform to Figure M-1 of AWS Building Code.
- D. Anchor Rods: ASTM F1554 grade 36.
- E. High-Strength Threaded Fasteners: ASTM A325 or ASTM A490.
- F. Filler Metal for Welding.
 - 1. Shielded metal - arc welding - AWS A5.1 or A5.5.
 - 2. Submerged - arc welding - AWS A5.17.
 - 3. Flux-cored arc welding - AWS A5.20.
- G. Grout: Non-shrink grout "Embeco Pre-mixed Grout" by Master Buildings or approved equal. The material shall be ready-to-use metallic aggregate product requiring only the addition of water at the job site, and shall produce a flowable grouting material having no drying shrinkage at any age. Compressive strength of grout (2" x 2" cubes) shall be not less than 4000 psi at 7 days and 7500 psi at 28 days.
- H. Paint: Fabricators standard conforming to SSPC Specifications.

2.2. FABRICATION

- A. Fabricate Structural Steel in accordance with the AISC Specification for Structural Steel.
 - 1. All work shall be shop-assembled in so far as possible and delivered to the site ready for erection. Material shall be properly marked and match-marked where field assembly is required. The sequence of shipments shall be such as to expedite erection and minimize field handling of material.
 - 2. Members to be milled shall be completely assembled before milling.
 - 3. Beams, girders, and trusses shall be cambered as indicated on the drawings. Specified camber shall be within a tolerance of minus zero to plus 1/8 inch per 10 feet of beam length. Members without specified camber shall be fabricated so that after erection any minor camber due to rolling or fabrication shall be upward.
 - 4. Shop connections shall be high-strength bolted or welded, as indicated on the

- structural drawings or as required.
- B. Field connections shall be high-strength bolted or welded, as indicated on the structural drawings or as required.
 - C. High-strength Bolted Construction Assembly: Tightening shall be done by the calibrated wrench method or the turn-of-the-nut method in accordance with Section 8 (d) of the Specifications for Structural Joints for all friction connections. For all bearing type bolted connections, bolts shall be installed to a snug tight fit with all plies in a joint in firm contact.
 - D. Welded Construction
 - 1. All welding done in accordance with AWS D1.1.
 - 2. Welding process shall be limited to one or more of the following:
 - a. Manual shielded-arc.
 - b. Submerged-arc.
 - c. Flux-cored arc.
 - 3. Preheat and interpass temperature shall conform Table 4.2, AWS D1.1.
 - 4. Welds not specified shall be continuous fillet welds, using minimum fillet as specified by AWS D1.1.
 - E. No combination of bolts and welds shall be used for stress transmission in the same faying face of any connections.
 - F. Bearing Plates:
 - 1. Bearing plates shall be provided under beams, girders, and trusses resting on footings, piers, and walls.
 - 2. Bearing plates shall be either attached or loose.
- 2.3. SOURCE QUALITY CONTROL - The Steel fabricator shall provide certification of the following to the Testing Agency for their review.
- A. Check steel plates and shapes for conformation to specifications.
 - B. Check high-strength threaded fasteners for conformance to the specifications.
 - C. Check filler metal for conformance to the specifications.
 - D. Determine chemical composition of all steel.
 - E. Determine mechanical properties, in accordance with ASTM A370, of the following materials:
 - 1. Steel shapes.
 - 2. Bars and plates.
 - 3. Headed stud type shear connectors.
 - 4. Anchor bolts.
 - 5. High-strength threaded fasteners.
 - 6. Filler metal for welding.
 - F. Qualification of shop bolting, welding, and stud welding and personnel.
 - G. Inspection of shop welds shall be in accordance with Section 6 of AWS Building Code and as follows:
 - 1. Visual inspection of all shop welds in accordance with Article 605.
 - 2. Ultrasonic testing in accordance with ASTM E164 of all penetration welds.
3. PART 3 EXECUTION
- 3.1. EXAMINATION
- A. Verify that field conditions are acceptable and are ready to receive work.
 - B. Beginning of installation means erector accepts existing conditions.
- 3.2. PREPARATION
- A. Clean and strip primed steel items to bare metal where site welding is required.

- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.3. ERECTION

- A. Erect structural steel in accordance with the AISC Specifications for Structural Steel, and the Code of Standard Practice for Steel Buildings and Bridges.
- B. Column Bases and Bearing Plates:
 - 1. Attached column bases and bearing plates for beams and similar structural members shall be aligned with wedges and shims.
 - 2. Loose column bases which are too heavy to be placed without a derrick or crane shall be set and wedged or shimmed or as noted on the structural drawings.
- C. Erection Tolerances:
 - 1. Individual pieces shall be erected so that deviation from plumb, level and alignment shall not exceed that specified in the AISC Code of Standard Practice, nor the following:
 - a. The displacement of the center-line of columns adjacent to elevator shaft, from the established column line, shall be not more than 1 inch at any point.
 - b. The displacement of the center-line of exterior columns, from the established column line, shall be not more than 1 inch toward, nor 2 inches away from the building line at any point.
- D. Field Assembly:
 - 1. Structural steel frames shall be accurately assembled to the lines and elevations indicated, within the specified erection tolerances.
 - 2. The various members forming parts of a complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.
 - 3. Fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact.
 - 4. Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.
 - 5. Splices shall be permitted only where indicated.
 - 6. Drift pins shall not be used to enlarge unfair holes in main material. Holes that must be enlarged to admit bolts shall be reamed. Burning and drifting may be used to align unfair holes in secondary members only upon approval of the Architect.
 - 7. Erection bolts used in welded construction may be either tightened securely and left in place or removed and the holes filled with plug welds.
- E. Gas Cutting: Field correcting of fabrication by gas cutting shall not be permitted on any major member in the structural framing without prior approval of the Architect and Engineer.
- F. Grouting of Base Plates and Bearing Plates: Plates shall be set and anchored to the proper line and elevation. Metal wedges, shims, and/or setting nuts shall be used for leveling and plumbing the structural members, including plumbing of columns. Concrete surfaces shall be rough, surfaces shall be clean and free of oil, grease, and rust. The addition of water and mixing shall be in conformance with the material manufacturer's instructions. Grout shall be mixed by using a mortar mixer. Batches shall be of size to allow continuous placement of freshly mixed grout. Placing shall be quick and continuous. Exposed surfaces shall have smooth, dense finish.

- G. Shop Painting:
 - 1. Apply shop coat of gray paint on steel surfaces except:
 - a. Surfaces of members to be field welded, in immediate area of welds.
 - b. Surfaces of members to receive sprayed-on fireproofing.
 - 2. Prepare surfaces by solvent cleaning (SPI-63) and hand or power tool spatters and other foreign matter.
 - H. Field Touch-Up Painting: After erection of structural steel, prime welds, abrasions and surfaces not shop primed, touch-up field welds and abrasions in shop paint coating with same paint used for shop painting.
- 3.4. FIELD QUALITY CONTROL: Testing agency shall perform the following:
- A. Check bracing.
 - B. Check location and set of anchor bolts and other inserts.
 - C. Prior to attaching steel, check adjustments to fit accuracies.
 - D. Qualification of field bolting, welding, and stud welding procedures and personnel.
 - E. Inspection of the erected structural framework for conformance with the requirements specified, including alignment, plumbness, camber, etc.
 - F. Inspection of Field Welds shall be in accordance with Section 6 of the AWS Building Code as follows:
 - 1. Visual inspection of all welds in accordance with Article 605.
 - 2. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
 - d. Ultrasonic Inspection: ASTM E 164.
 - 3. All column-to-base plate field welds shall be inspected by ultrasonic testing in accordance with ASTM E164.
 - 4. All welds that fail shall be rewelded and retested until they pass the test. The cost of the initial test and all further testing on welds that fail shall be borne by the Contractor. All initial weld tests that pass will be paid by the Owner.
 - G. Inspection of high-strength bolted construction shall be in accordance with Section 9, AISC Specifications for Structural Joints, and as follows:
 - 1. Friction Connections
 - a. All high-strength bolted connections shall be visually inspected.
 - b. At least two bolts of every third connection between floor beams and girders shall be checked with a calibrated torque wrench for proper torque.
 - c. At least two bolts of every connection between girders and columns shall be checked as above.
 - d. All bolted connections that fail shall be corrected and all bolts in that connection

- tests that fail shall be paid by the Owner. The cost of retests on connections that fail shall be borne by the contractor.
- e. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.
2. Bearing Connections
- a. All high-strength bolted connections shall be visually inspected to ensure that all plies of the connected elements have been brought into snug contact.
- H. Field testing of welded stud shear connectors shall be in accordance with sections 4.29 and 4.30 of the AWS Structural Welding Code, and as follows:
- 1. Visual inspection shall be made for all studs for proper number and quality of welds. Any studs that do not have a full 360 degree filled weld shall be tested.
 - 2. In addition to defective studs visually observed, a prescribed pattern of selecting studs for testing shall be followed.
 - a. Any member having more than 20 studs shall have at least two studs tested.
 - b. Members having less than 20 studs shall be tested as a group. Select two studs randomly from each sample of 100 studs to be tested.
 - 3. Testing shall consist of bending the stud to an angle of 30 degrees from its original axis by striking the stud with a hammer.
 - 4. If failure occurs during testing, inspector shall test adjacent studs as required to determine extent of poor welding.
 - 5. Stud replacement or repair shall be in accordance with AWS Structural Welding Code sections 4.29 and 4.30.

END OF SECTION 05 12 00

SECTION 051200 - STRUCTURAL STEEL FRAMING

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. Structural steel.
- 2. Grout.

B. Related Sections:

- 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
- 2. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
- 3. Division 05 Section "Metal Stairs."

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Heavy Sections: Rolled and built-up sections as follows:

- 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
- 2. Column base plates thicker than 2 inches.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator.

- 1. Select and complete connections using schematic details indicated and AISC 360.
- 2. Use ASD; data are given at service-load level.

- B. Construction: Concrete and masonry shear walls.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing.
- D. Qualification Data: For qualified Installer, fabricator, professional engineer.
- E. Welding certificates.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- G. Mill test reports for structural steel, including chemical and physical properties.
- H. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - 6. Nonshrink grout.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.

2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- C. Provide documentation required by IBC 1704.2.5.
- D. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M unless noted.

- C. Plate and Bar: ASTM A 36/A 36M unless noted.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A 847/A 847M, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - 1. Weight Class: As indicated.
 - 2. Finish: Black.
- G. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
- H. Steel Forgings: ASTM A 668/A 668M.
- I. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts[or tension-control, bolt-nut-washer assemblies with splined ends]; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. Headed Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, weldable as indicated, straight.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Plain.

F. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: ASTM F 436, Type 1, hardened carbon steel.
3. Finish: Plain.

2.3 PRIMER

- A. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time; Minimum compressive strength of 7,000-psi.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, unless noted.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.

- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. Exterior exposed steel: Abrasive blast in accordance with SSPC-SP6 Commercial Blast Cleaning.
 - 2. All other steel: SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened unless noted.
 2. Joints specified on the drawings to be slip-critical (SC) shall have direct-tension indicators.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 3 power-tool cleaning.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. LH-series steel joists.
 - 2. Joist accessories.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for installing bearing plates in concrete.
 - 2. Division 04 Section "Unit Masonry" for installing bearing plates in unit masonry.

1.3 DEFINITIONS

- A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
- B. Design special joists to withstand design loads with live load deflections no greater than the following:
 - 1. Roof Joists: Vertical deflection of 1/240 of the span.

1.5 SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product indicated.
- B. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. Indicate locations and details of bearing plates to be embedded in other construction.

- C. Welding certificates.
- D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.
- E. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.
- F. Qualification Data: For manufacturer.
- G. Field quality-control test and inspection reports.
- H. Research/Evaluation Reports: For joists.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

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- B. Steel Bearing Plates: ASTM A 36/A 36M.
- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Plain, uncoated.
- D. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
- E. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
- B. Primer: Provide shop primer that complies with Division 09 painting Sections.

2.3 LH-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, LH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: LH-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- D. Provide holes in chord members for connecting and securing other construction to joists.
- E. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- G. Camber joists according to SJI's "Specifications."

- H. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.
- C. Bridging: Fabricate as indicated and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.
- D. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.
- E. Steel bearing plates with integral anchorages are specified in Division 05 Section "Metal Fabrications."
- F. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.
- G. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.
- D. Shop priming of joists and joist accessories is specified in Division 09 painting Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Bolt joists to supporting steel framework using high-strength structural bolts at column locations. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

- B. Field welds will be visually inspected according to AWS D1.1/D1.1M.
- C. In addition to visual inspection, field welds will be tested according to AWS D1.1/D1.1M and the following procedures, as applicable:
 - 1. Radiographic Testing: ASTM E 94.
 - 2. Magnetic Particle Inspection: ASTM E 709.
 - 3. Ultrasonic Testing: ASTM E 164.
 - 4. Liquid Penetrant Inspection: ASTM E 165.
- D. Bolted connections will be visually inspected.
- E. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
- F. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.
- G. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
 - 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.
- D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 05 31 00 - STEEL DECK**PART 1 GENERAL****1.1. SECTION INCLUDED**

- A. Composite steel floor deck.

1.2. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Section 03 30 00 - Cast-in-Place Concrete for concrete fill and reinforcing steel.
- C. Section 05 50 00 - Metal Fabrications for framing openings with miscellaneous steel shapes.

1.3. SUBMITTALS FOR REVIEW

- A. Section 01300 – Submittals: Procedures for submittals.
- B. Product data for each type of deck, accessory, and product specified.
- C. Shop drawings showing layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
- D. For steel deck indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for its preparation.
- E. Product certificates signed by manufacturers of steel deck certifying that their products comply with specified requirements.
- F. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- G. Product test reports from qualified independent testing agencies evidencing compliance with requirements of the following based on comprehensive testing:
 - 1. Mechanical fasteners.
- H. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence steel deck's compliance with the building code in effect for the Project.

1.4. QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. Fire-Test-Response Characteristics: Where indicated, provide steel deck panels identical to those tested as part of an assembly for fire resistance per ASTM E 119 by a testing and

inspection agency performing testing and follow-up services, that is acceptable to authorities having jurisdiction.

- E. Fire-Resistance Ratings: As indicated by design designations listed in UL "Fire Resistance Directory," or by Warnock Hersey or another testing and inspecting agency.
- F. Labeling: Identify steel deck with appropriate markings of applicable testing and inspecting agency.
- G. Electrical Raceway Panels: Provide UL-labeled, cellular metal floor deck panels conforming to UL 209 and listed in UL "Electrical Construction Materials Directory" as approved for use with standard header ducts and outlets for electrical distribution systems.
- H. FM Listing: Provide steel roof deck evaluated by Factory Mutual and listed in Factory Mutual "Approval Guide" for Class 1 fire rating and Class 1-60 windstorm ratings.
- I. Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of steel deck similar to this Project in material, design, and extent and that have a record of successful in-service performance.

1.5. DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

2. PART 2 – PRODUCTS

2.1. MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Epic Metals Corp.
- C. United Steel Deck, Inc.
- D. Vulcraft Div. of Nucor Corp.
- E. Wheeling Corrugating Co., Div. of Wheeling-Pittsburgh Steel Corp.

2.2. ROOF DECK

- A. Steel Roof Deck: Fabricate panels without top-flange stiffening grooves conforming to SDI Publication No. 28 "Specifications and Commentary for Steel Roof Deck" and the following:
 - 1. Galvanized-Steel Sheet: ASTM A 446, Grade A, G 60 (ASTM A 446M, Grade A, Z 180) zinc coated according to ASTM A 525 (ASTM A 525M).
 - 2. Deck Profile: 1.5B Wide Rib
 - 3. Profile Depth: 1-1/2 inches
 - 4. Design Uncoated-Steel Thickness: 0.0295 inch (22 gage).
 - 5. Span Condition: Three span or more.
 - 6. Side Joints: Overlapped or interlocking seam at Contractor's option.
- B. COMPOSITE DECK

1. Composite Steel Deck: Fabricate ribbed-steel sheet composite form deck panels conforming to ANSI/SDI C-2017 "Standard for Composite Steel Floor Deck – Slabs," the minimum section properties indicated, and the following:
 2. Galvanized-Steel Sheet: ASTM A 446, Grade E, G 60 (ASTM A 446M, Grade E, Z 180) zinc coated according to ASTM A 525 (ASTM A 525M).
 3. Profile Depth: 3 inch.
 4. Design Uncoated-Steel Thickness: 20 gage.
 5. Span Condition: Three span or more.
 6. Side Joints: Overlapped or interlocking seam at Contractor's option.
- C. Long Span Acoustic Steel Roof Deck: Fabricate panels without top-flange stiffening grooves conforming to SDI Publication No. 28 "Specifications and Commentary for Steel Roof Deck" and the following:
1. Galvanized-Steel Sheet: ASTM A 563 SS, Grade 40, G 60.
 2. Deck Profile: Toris 4A
 3. Profile Depth: 4 inches
 4. Design Uncoated-Steel Thickness: 0.0295 inch (22 gage).
 5. Span Condition: Three span or more.
 6. Side Joints: Overlapped or interlocking seam at Contractor's option.
- D. ACCESSORIES
1. General: Provide accessory materials for steel deck that comply with requirements indicated and recommendations of the steel deck manufacturer.
 2. Mechanical Fasteners: Manufacturer's standard, corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon steel fasteners; or self-drilling, self-threading screws.
 3. Side Lap Fasteners: Manufacturer's standard, corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 10 (4.8 mm) minimum diameter.
 4. Miscellaneous Roof Deck Accessories: Steel sheet, 0.0359 inch thick minimum ridge and valley plates, finish strips, and reinforcing channels, of same material as roof deck.
 5. Pour Stops and Girder Fillers: Steel sheet, of same material as deck panels, and of thickness and profile indicated.
 6. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material and thickness as deck panels, unless otherwise indicated.
 7. Hanger Tabs: Manufacturer's standard piercing steel sheet hanger attachment devices for floor deck panels.
 8. Weld Washers: Manufacturer's standard uncoated-steel sheet weld washers, shaped to fit deck rib, 0.0598 inch thick with 3/8-inch minimum diameter prepunched hole.
 9. Recessed Sump Pans: Manufacturer's standard size, single piece steel sheet 0.071 inch thick minimum, of same material as deck panels, with 1-1/2 inch minimum deep level recessed pans and 3 inch wide flanges. Cut holes for drains in the field.
 10. Flat Receiver Pan: Manufacturer's standard size, single piece steel sheet, 0.071 inch thick minimum units, of same material as deck panels. Cut holes for drains in the field.
 11. Steel Sheet Accessories: ASTM A 446, G 60 (ASTM A 446M, Z 180) coating class, galvanized according to ASTM A 525 (ASTM A 525M).
 12. Galvanizing Repair Paint: SSPC Paint 20 or DOD P 21035, with dry film containing a minimum of 94 percent zinc dust by weight.
 13. Preset Inserts: Manufacturer's standard, UL labeled single piece preset inserts, fabricated from either steel sheet galvanized according to ASTM A 525, G 60

(ASTM A 525M, Z 180) coating class, or zinc sheet, with removable covers.

3. 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.

3.2. PREPARATION

- A. Do not place deck panels on concrete supporting structure until concrete has cured and is dry.
- B. Locate decking bundles to prevent overloading of supporting members.

3.3. INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary of SDI Publication No. 28, manufacturer's recommendations, and requirements of this Section.
- B. Install temporary shoring before placing deck panels when required to meet deflection limitations.
- C. Place deck panels on supporting framing and adjust to final position with ends accurately aligned and bearing on supporting framing before being permanently fastened. Do not stretch or contract side lap interlocks.
- D. Place deck panels flat and square and fasten to supporting framing without warp or deflection.
- E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to the decking.
- F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
- G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
- H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's instructions.

3.4. ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches long, and as follows:
- B. Weld Diameter: 5/8 inch, nominal.
- C. Weld Spacing: Weld edge ribs of panels at each support. Space welds an average of 12 inches apart, with a minimum of two welds per unit at each support.
- D. Weld Washers: Install weld washers at each weld location.
- E. Side Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding 36 inches, using one of the following methods:
 - 1. Mechanically fasten with self-drilling No. 10 diameter or larger carbon steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with 1-1/2 inch long minimum welds.

- F. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.
- G. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking, and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
- H. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's recommendations. Weld to substrate to provide a complete deck installation.

3.5. FLOOR DECK INSTALLATION

- A. Fasten floor deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
 - 3. Weld Washers: Install weld washers at each weld location.
 - 4. Side Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, or at intervals not exceeding 36 inches, using one of the following methods:
 - 1. Mechanically fasten with self-drilling No. 10 diameter or larger carbon steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with 1-1/2 inch long minimum welds.
 - 5. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped or butted at Contractor's option.
 - 6. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
 - 7. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck according to SDI recommendations to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless otherwise indicated.

3.6. FIELD QUALITY CONTROL

- A. Testing Agency: A qualified independent testing agency employed and paid by Owner will perform field quality control testing.
- B. Field welds will be subject to inspection.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional testing will be performed to determine compliance of corrected work with specified requirements.

3.7. REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces with galvanized repair paint according to ASTM A 780 and the manufacturer's instructions.

- B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on both surfaces of installed deck panels.
- C. Touch up painted surfaces with same type of shop paint used on adjacent surfaces.
- D. Where shop painted surfaces are exposed in service, apply touchup paint to blend into adjacent surfaces.
- E. Provide final protection and maintain conditions to ensure steel decking is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Acoustical roof deck.
 - 3. Noncomposite form deck.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
 - 2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 3. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 4. Division 09 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.
- D. Welding certificates.
- E. Field quality-control test and inspection reports.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
 - 2. Acoustical roof deck.

- G. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- E. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

1.6 COORDINATION

- A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Division 07 Section to ensure protection of insulation strips against damage from effects of weather and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Deck:
 - a. ASC Profiles, Inc.
 - b. Canam Steel Corp.;The Canam Manac Group.
 - c. Consolidated Systems, Inc.
 - d. DACS, Inc.
 - e. D-Mac Industries Inc.
 - f. Epic Metals Corporation.
 - g. Marlyn Steel Decks, Inc.
 - h. New Millennium Building Systems, LLC.
 - i. Nucor Corp.; Vulcraft Division.
 - j. Roof Deck, Inc.
 - k. United Steel Deck, Inc.
 - l. Valley Joist; Division of EBSCO Industries, Inc.
 - m. Verco Manufacturing Co.
 - n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40 (275) , G60 (Z180) zinc coating.
 - 2. Deck Profile: Type 3DR, deep rib.
 - 3. Profile Depth: 3 inches (76 mm)
 - 4. Design Uncoated-Steel Thickness: As indicated.
 - 5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
 - 6. Span Condition: As indicated.
 - 7. Side Laps: Overlapped.

2.3 ACOUSTICAL ROOF DECK

- A. Acoustical Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 40 (275) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Gray top surface with white underside.
 2. Deck Profile: As indicated.
 3. Profile Depth: As indicated.
 4. Design Uncoated-Steel Thickness: As indicated.
 5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
 6. Span Condition: As indicated.
 7. Side Laps: Overlapped.
 8. Acoustical Perforations: Deck units with manufacturer's standard perforated vertical webs.
 9. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.
 - a. Factory install sound-absorbing insulation into cells of cellular deck.
 10. Acoustical Performance: NRC 0.90, tested according to ASTM C 423.

2.4 NONCOMPOSITE FORM DECK

- A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Gray top surface with white underside.
 2. Profile Depth: 1 inch.
 3. Design Uncoated-Steel Thickness: As indicated.
 4. Span Condition: As indicated.
 5. Side Laps: Overlapped.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated.
 - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped 2 inches (51 mm) minimum.
- D. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in in Division 07 Section.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch (16 mm), nominal.
 - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
 - 3. Weld Spacing: Space and locate welds as indicated.
 - 4. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (910 mm), and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.

- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09 Section.
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09 Section.
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 05 40 00 - COLD-FORMED METAL STUDS**1. PART 1 GENERAL****1.1. RELATED DOCUMENTS**

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

1.2. SUMMARY

- A. This Section includes the following:
 - 1. Interior and exterior bearing and non-bearing steel-stud walls.

1.3. PERFORMANCE REQUIREMENTS

- A. AISI "Specifications": Calculate structural characteristics of cold-formed metal framing according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and the following:
 - 1. Center for Cold-Formed Steel Structures (CCFSS) Technical Bulletin, Vol. 2, No. 1, February 1993 "AISI Specification Provisions for Screw Connections."
- B. Structural Performance: Engineer, fabricate and erect cold-formed metal framing with the following minimum physical and structural properties:
 - 1. Physical and Structural Properties: As indicated.
- C. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
 - 1. Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Load-Bearing Walls: Lateral deflection of 1/360 of the wall height.
 - b. Roof Joists: Vertical deflection of 1/360 of the span.
- D. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 deg F.
- E. Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.

1.4. SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of cold-formed metal framing, accessory, and product specified.

1.5. QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.6. DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

2. PART 2 – PRODUCTS

2.1. MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated in the Work include, but are not limited to, the following:
1. Alabama Metal Industries Corp.
 2. American Studco, Inc.
 3. Angeles Metal Systems.
 4. California Metal Systems, Inc.
 5. Clark, Inc.
 6. Consolidated Fabricators Corp.
 7. Consolidated Systems, Inc.
 8. Dale//Incor Industries.
 9. Dale Industries, Inc.
 10. Design Shapes in Steel.
 11. Dietrich Industries, Inc.
 12. Incor Plant Dale Industries.
 13. MarinoWare; Div. of Ware Industries, Inc.
 14. Super Stud Building Products, Inc.
 15. Unimast, Inc.
 16. United Construction Supply.
 17. United States Steel.
 18. Western Metal Lath Co.

2.2. MATERIALS

- A. Galvanized-Steel Sheet: ASTM A 446, zinc coated according to ASTM A 525, and as follows:
1. Coating Designation: G 60 (Z 180).
 2. Grade: As required by structural performance.
- B. Prime-Painted Steel Sheet: ASTM A 570 or ASTM A 611, cleaned, pretreated, and primed with manufacturer's baked-on, lead- and chromate-free, rust-inhibitive primer conforming to the performance requirements of FS TT-P-664.
- C. Grade: As required by structural performance.

2.3. WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depths indicated, with lipped flanges, and complying with the following:
1. Gauge: 16 ga. or as per plan.
 2. Flange Width: Minimum 1-5/8 inches.
 3. Web: Punched.
- B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
1. Design Uncoated-Steel Thickness: 1 gauge heavier than steel studs.

2.4. JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, unpunched, of web depths indicated, with lipped flanges, and complying with the following:

1. Gauge: 16 ga. or as per plans.
2. Flange Width: 1-5/8 inches minimum.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, unpunched, of web depths indicated, with straight flanges, and complying with the following:
 1. Design Uncoated-Steel Thickness: 1 gauge heavier than steel joists.

2.5. FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Gusset plates.
 5. Deflection track and vertical slide clips.
 6. Stud kickers and girts.
 7. Joist hangers and end closures.
 8. Reinforcement plates.

2.6. ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by the hot-dip process according to ASTM A 123.
- B. Cast-in-Place Anchor Bolts and Studs: ASTM A 307, Grade A; carbon-steel hex-head bolts and studs; carbon-steel nuts; and flat, unhardened-steel washers. Zinc coated by the hot-dip process according to ASTM A 153.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws.
 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.7. MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and a 30-minute working time.

2.8. FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS 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 cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
 - 3. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to manufacturer's recommendations.
 - B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.
 - C. Fabrication Tolerances: Fabricate assemblies to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.
3. PART 3 – EXECUTION
- 3.1. EXAMINATION
- A. Examine supporting substrates and abutting structural framing for compliance with requirements, including installation tolerances and other conditions affecting performance of cold-formed metal framing. Do not proceed with installation until unsatisfactory conditions have been corrected.
- 3.2. PREPARATION
- A. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.
- 3.3. INSTALLATION, GENERAL
- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
 - B. Install cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS 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 cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

- C. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
- D. Provide temporary bracing and leave in place until framing is permanently stabilized.
- E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- F. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and double studs, inaccessible upon completion of framing work.
- G. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.
- H. Erection Tolerances: Install cold-formed metal framing to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4. LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings recommended by the manufacturer, but not greater than the following:
 - 1. Spacing: 24 inches for nail or power-driven anchors.
 - 2. Spacing: 32 inches for cast-in-place or expansion anchors.
- B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track. Space studs as follows:
 - 1. Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Align studs vertically where wall-framing continuity is interrupted by floor framing. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align joists over studs. Where joists cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than the stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated or required by manufacturer.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. Where type of supplementary support is not indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or load resulting from item supported.

- I. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5. JOIST INSTALLATION

- 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 or as recommended by the manufacturer.
- B. Install joists bearing on supporting framing, level, straight, and plumb, adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 1. Install joists over supporting framing with a minimum end bearing of 1-1/2 inches.
 2. Reinforce ends of joists with web stiffeners, end clips, joist hangers, steel clip angles, steel-stud sections, or as otherwise recommended by manufacturer.
- 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, nesting joists, or another combination of connected joists where indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or by other method recommended by joist manufacturer.
 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at each end of joists and at intervals indicated. Fasten bridging at each joist intersection as follows:
 1. Bridging: Cold-rolled steel channel, fastened to bottom flange of joists.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. 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.

3.6. REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanizing repair paint according to ASTM A 780 and the manufacturer's instructions.
- B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing.
 1. Touchup painted surfaces with same type of shop paint used on adjacent surfaces.
- C. Protect gypsum sheathing that will be exposed to weather for more than one month as follows:
 1. Protect cutouts, corners, and joints in the sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at the time sheathing is applied.
- D. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer to ensure that cold-formed metal framing is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

1 PART 1 GENERAL

1.1 SECTION INCLUDES

- A Shop fabricated ferrous metal items, galvanized and prime painted.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A Section 03 30 00 - Cast-In-Place Concrete: Placement of metal fabrications in concrete.

1.3 RELATED SECTIONS

1.4 REFERENCES

- A ASTM A36 - Structural Steel.
- B ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
- D ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- F ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- G ASTM A325 - High Strength Bolts for Structural Steel Joints.
- H ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
- I ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- J ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- K ASTM B177 - Chromium Electroplating on Steel for Engineering Use.
- L AWS A2.0 - Standard Welding Symbols.
- M AWS D1.1 - Structural Welding Code.
- N SSPC - Steel Structures Painting Council.
- O OSHA/ANSI A14.3 Standards for fixed wall ladders.

1.5 DESIGN REQUIREMENTS

- A Meet requirements and recommendations of applicable portions of the Standards listed.
 - i Architectural Aluminum Manufacturers Association AAMA
 - ii American Hot Dip Galvanizers Association AHDGA
 - iii American Institute of Steel Construction AISC
 - iv American Society for Testing and Materials ASTM
 - v American National Standards Institute ANSI
 - vi American Welding Society AWS
 - vii National Association of Architectural Metal Manufacturers NAAMM

1.6 SUBMITTALS

- A Submit under provisions of Section 01 30 00.
- B Meet requirements of applicable portions of "Structural Shop Drafting" by AISC.
- C Shop Drawings: Indicate materials, shapes, profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Show Locations and Markings. Include erection drawings, elevations, and details where applicable. Note and

mark sufficiently to indicate compliance with requirements of these specifications.

- D Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.7 QUALIFICATIONS

- A Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the state where the Project is located.
- B Welders Certificates: Submit under provisions of Section 01300, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.8 FIELD MEASUREMENTS

- A Verify that field measurements are as indicated on Drawings.

2 PART 2 PRODUCTS

2.1 MATERIALS

- A Steel Sections: ASTM A36 and ASTM A440 having a minimum yield strength not less than 36,000 psi.
- B Steel Tubing: ASTM A500, Grade B, and ASTM A501.
- C Plates: ASTM A283
- D Pipe: ASTM A53, Grade B Schedule 40.
- E Cast Steel - ASTM A27, Grade 65 - 35; and ASTM A140, Grade 80-50.
- F Steel Forgings - ASTM A235 and ASTM A237.
- G Cast Iron - ASTM A48, Class 30, min. 30,000 PSI tensile.
- H Malleable Iron - ASTM A47 and ASTM A197.
- I Bolts, Nuts, and Washers: ASTM A307, ASTM A325 and ASTM A195 [galvanized to ASTM A153 for galvanized components].
- J Fasteners:
 - i Fasteners shall be of the type required for the purpose intended and particular application and shall be of a recognized industry standard for the type of components. Fasteners shall include:
 - a Masonry Sleeve Anchors - Molly "Parasleeve", Ramset "Dyna Bolt", or approved equal.
 - b Concrete Expansion Bolts - Hilti "Kwik Bolt" or approved equal.
 - c Hollow Wall Fasteners - Hilti "Kwik Tog" or approved equal.
 - d Plaster and Drywall Fasteners - Plastic insert wedges.
 - e Adhesive anchors - Hilti "HVA Adhesive Anchor" or approved equal.
- K Pipe Connection Fittings
 - i Clamp-on Tee Fittings:
 - a Kee Industrial Products; Product: No. 16 Clamp-on Tee - 16-7 (1-1/4 to 1-1/4 inch pipe size).
 - b R&B Wagner, Inc.; Product: No. 16 Clamp-on Tee - 16-7 (1-1/4 to 1-1/4 inch pipe size).
- L Welding Materials: AWS D1.1; type required for materials being welded.
- M Welding Electrodes: Electrodes shall be of the type required for the purpose intended. Use E70 series for manual arc welding.
- N Filler Metal - ASTM A233, E60 or R70 series.
- O Paint - F.S. TT-P636 Red Oxide.
- P Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

- Q Galvanizing: Galvanized metals shall conform to ASTM A-123 and ASTM A-386.
- R Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic zinc rich.

2.2 FABRICATION

- A Meet requirements specified under Structural Steel for fabricating items of a structural nature or use.
- B Fit and shop assemble in largest practical sections, for delivery to site.
- C Fabricate items with joints tightly fitted and secured.
- D Weld permanent shop connections.
- E Continuously seal joined members by [intermittent welds and plastic filler.] or [continuous welds.]
- F Grind exposed joints and welds flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- G Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- H Supply components required to complete the work and for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- I Furnish all bolts, nuts, clip angles, etc. as shown on Drawings and as required to complete the work.
- J Punch or drill for temporary field connections and for attachment of work by other trades.
- K Form materials to shapes indicated with straight lines, sharp angles and smooth curves. Drill or punch holes and smooth edges.
- L Form bends smooth without wrinkles, kinks or flat spots.
- M Galvanize all exterior assemblies after fabrication, including all masonry shelf angles and lintels.

2.3 PIPE HANDRAILS FOR CAST - IN- PLACE CONCRETE STAIRS

- A Fabricate handrails of standard weight black steel pipe of sizes indicated.
- B Form bends smooth without wrinkles, kinks, or flat spots.
- C Weld all joints and grind smooth.
- D Fabricate handrails of one continuous piece in each run with no joints within a stair run.
- E Support handrails with wall supported brackets anchored into brick as detailed on Drawings. Brackets placed at 5' - 0" o.c. maximum.
- F Secure handrails as detailed. Exterior handrails shall be galvanized after fabrication.

2.4 FABRICATED PRODUCTS

- A Exterior Roof Ladder
 - i System Includes
 - a Caged exterior ladder with intermediate rest platform, walk-through roof over extensions and security doors.
 - ii Manufacturers
 - a Alaco Ladder Co.; Product: Series 560 Fixed Wall Ladders.
 - b Precision Stairs Corp.; Product: Model FL.
 - c Royalite Manufacturing, Inc.; Product: CL Cage Ladders.
 - iii Fabrication
 - a Material: Aluminum 6061-T6 or 6063T-5 alloy with mill finishes.

- b Treads: Extruded aluminum either 2-1/4 inch wide channel or 1-1/8 inch round x 20 inches long with serrated surface. Connect treads to side rails with solid rivets rated 934 pounds shear strength each minimum. Space treads at 12 inch o.c. Treads shall be rated to withstand 1,000 pound load.
- c Siderails: 0.125 inch thick x 2 1/2 inch wide secured to wall with 1/8 inch thick brackets at 6 foot on center.
- d Safety Cage: 1/4 x 2 inch bars at 4 foot on center maximum. Vertical bars; 3/16 x 1 1/2 inch. Cage connections shall be riveted or gas shielded metal arc welded. Cage shall be bolted to siderails.
- e Rest Platform: Grip strut floor with .063 inch thick x 4 inch wide toe boards and 42 inch high transfer guard rail.
- f Walk-through Roofover Extensions: Extend 42 inches above landing with grab rails extending perpendicular to plane of roof ladder over the roof.
- g Security Doors: Minimum .063 inch thick secured to side rails with aluminum piano hinges and hasps.
- h Provide roof ladder as a complete assembly with all required components, fasteners and accessories.

2.5 FINISHES

- A Prepare surfaces to be primed in accordance with SSPC SP 2. Clean ferrous metal of scale, rust, oil, moisture and dirt before [applying paint.]
- B Apply two shop prime coats to all work after fabrication except galvanized metal, stainless steel, aluminum, copper, brass, bronze and metals to receive special coatings unless noted otherwise. Do not prime surfaces in direct contact with concrete or where field welding is required. Use asphalt paint on metals anchored into masonry, and concrete.
- C Apply three shop prime coats to ferrous metals that will be inaccessible after erection.
- D Painting specified here does not count as a coat for finish painting.
- E Galvanize in accordance with ASTM A123, structural steel members. Provide minimum 1.25 oz/sq ft galvanized coating] as scheduled.
- F Chrome Plating: ASTM B177, weight, nickel-chromium alloy, [satin] [polished] finish.

3 PART 3 EXECUTION

3.1 EXAMINATION

- A Verify that field conditions are acceptable and are ready to receive work.
- B Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

- A Clean and strip primed steel items to bare metal where site welding is required.
- B Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.3 INSTALLATION

- A Install items plumb and level, accurately fitted, free from distortion or defects and true to line. Shim bearing plates with metal and grout solid.
- B Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C Field weld components indicated on shop drawings and grind smooth where practicable,

conceal fastenings where practicable.

- D Perform field welding in accordance with AWS D1.1.
- E Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.
- F After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
- G Secure metal to wood with lag screws, of adequate size, with appropriate washers.
- H Secure metal to masonry with embedded anchors, setting compound, lead caulking and sleeves, or cement-sand grouting.
- I Expansion bolts, toggle bolts, and screws are permitted for light duty service only.
- J Meet requirements specified for structural steel for erecting items of structural nature and use.
- K Metal work, in place, shall be reviewed before being covered.

3.4 PAINTING

- A Retouch, in field, all scrapped, abraded and unpainted surfaces. Painting as specified for shop coats.

3.5 CLEANING

- A Refer to Section 01700 – Cleaning.
- B Clean items prior to final inspection in accordance with the recommendations of the fabricator.

3.6 ERECTION TOLERANCES

- A Maximum Variation From Plumb: $\frac{1}{4}$ inch per story, non-cumulative.
- B Maximum Offset From True Alignment: $\frac{1}{4}$ inch.

END OF SECTION 05 50 00

SECTION 055100 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preassembled steel stairs with concrete-filled treads.
 - 2. Steel tube railings attached to metal stairs.
 - 3. Steel tube handrails attached to walls adjacent to metal stairs.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
 - 2. Division 5 Section "Metal Fabrications" for metal treads and nosings not installed in metal stairs.
 - 3. Division 9 Section "Gypsum Board Assemblies" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft..
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
- B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.

- b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- 2. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- 3. Infill of Guards:
 - a. Concentrated load of 200 lbf applied horizontally on an area of 1 sq. ft..
 - b. Uniform load of 25 lbf/sq. ft. applied horizontally.
 - c. Infill load and other loads need not be assumed to act concurrently.
- C. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 705, "Minimum Design Loads for Buildings and Other Structures".

1.4 SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Prefilled metal-pan stair treads.
 - 2. Abrasive nosings.
 - 3. Paint products.
 - 4. Grout.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
 - 2. Structural analysis data and shop drawings signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes:
 - 1. Precast concrete treads.
 - 2. Epoxy-resin-filled stair treads.
 - 3. Stair treads with nonslip-aggregate surface finish.
 - 4. Metal floor plate treads.
 - 5. Grating treads.
 - 6. Abrasive nosings.
- E. Welding certificates.

- F. Qualification Data: For professional engineer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.
 - 1. Test railings according ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.
- C. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. 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.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 (cold formed).
- C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- D. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface.
 - 1. Available Products:
 - a. IKG Industries, a Harsco company; Mebac.
 - b. W. S. Molnar Company; SlipNOT.
- E. Steel Bars for Grating Treads: ASTM A 36/A 36M.
- F. Wire Rod for Grating Crossbars: ASTM A 510.
- G. Iron Castings: Either gray or malleable iron, unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
 - 2. Malleable Iron: ASTM A 47/A 47M.
- H. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.
- I. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M structural steel, Grade 30, unless another grade is required by design loads.
- J. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, structural steel, Grade 33, unless another grade is required by design loads.

2.4 NONFERROUS METALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- B. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.5 ABRASIVE NOSINGS

- A. Cast-Metal Units: Cast gray iron, Class 20, aluminum, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
1. Available Manufacturers:
 - a. American Safety Tread Co., Inc.
 - b. Balco Inc.
 - c. Barry Pattern & Foundry Co., Inc.
 - d. Granite State Casting Co.
 - e. Safe-T-Metal Co.
 - f. Wooster Products Inc.
 2. Configuration: Cross-hatched units, 4 inches wide without lip.
 3. Configuration: Cross-hatched angle-shaped units, same depth as bar-grating treads and 1 to 1-1/2 inches wide.
- B. Extruded Units: Extruded-aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
1. Available Manufacturers:
 - a. ACL Industries, Inc.
 - b. American Safety Tread Co., Inc.
 - c. Amstep Products.
 - d. Armstrong Products, Inc.
 - e. Balco Inc.
 - f. Granite State Casting Co.
 - g. Wooster Products Inc.
 2. Provide solid-abrasive-type units without ribs.
 3. Nosings: Square-back units, 4 inches wide, without lip.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- D. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.
- E. Apply clear lacquer to concealed bottoms, sides, and edges of extruded units set into concrete.

2.6 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3.
- E. Plain Washers: Round, ASME B18.22.1.
- F. Lock Washers: Helical, spring type, ASME B18.21.1.
- G. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.7 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Available Products:
 - a. Carboline Company; Carbozinc 621.
 - b. ICI Devoe Coatings; Catha-Coat 313.
 - c. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.

- d. Moore, Benjamin, & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
- I. Welded Wire Fabric: ASTM A 185, 6 by 6 inches--W1.4 by W1.4, unless otherwise indicated.

2.8 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
- 1. Join components by welding, unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Weld exposed corners and seams continuously, unless otherwise indicated.
 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.
- H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.9 STEEL-FRAMED STAIRS

A. Stair Framing:

1. Fabricate stringers of steel channels or tubes.
 - a. Provide closures for exposed ends of channel and tube stringers.
2. Construct platforms of steel channel and tube headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.

1. Steel Sheet: Uncoated cold or hot-rolled steel sheet, unless otherwise indicated.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
4. Shape metal pans to include nosing integral with riser.
5. Attach abrasive nosings to risers.

6. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
7. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.10 STEEL TUBE RAILINGS

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
 1. Configuration: 1-5/8-inch- diameter top and bottom rails, 1-1/2-inch- square posts, and 1/2-inch- square pickets spaced less than 4 inches clear.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
- C. Form changes in direction of railings as follows:
 1. By flush bends or by inserting prefabricated flush-elbow fittings.
- D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 1. Connect posts to stair framing by direct welding, unless otherwise indicated.
 2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.11 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 - 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
 - 1. Exterior Stairs (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
 - 3. Interior Stairs Indicated to Receive Zinc-Rich Primer (SSPC Zone 1A): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- E. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Place and finish concrete fill for treads and platforms to comply with Division 3 Section "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.
- H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING STEEL TUBE RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - 1. Anchor posts to steel by welding directly to steel supporting members.

2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
 3. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 4. For hollow masonry anchorage, use toggle bolts.
 5. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
 6. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
 7. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055100

SECTION 055133.13 – ALUMINUM FIXED VERTICAL LADDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum Fixed Vertical Ladders.
- B. See section 083100 for Floor Access Door

1.2 RELATED SECTIONS

- A. Section 05550 - Metal Fabrications: Miscellaneous metal supports.

1.3 REFERENCES

- A. ANSI A14.3: Ladders - Fixed - Safety Requirements.
- B. OSHA 1910.23: Ladders.
- C. OSHA 1910.28: Duty to have fall protection and falling object protection.
- D. OSHA 1910.29: Fall protection systems and falling object protection-criteria and practices.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
- C. Shop Drawings for Ladders:
 - 1. Plan and section of ladder installation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products until installation inside under cover. If stored outside, under a tarp or suitable cover.

1.6 WARRANTY

- A. Limited Warranty: Five years against defective material and workmanship, covering parts only, no labor or freight. Defective parts, if deemed so by the manufacturer, will be replaced at no charge, freight excluded, upon inspection at manufacturer's plant which warrants same.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide Precision Ladders, LLC, which is located at: P. O. Box 2279 ; Morristown, TN 37816-2279; Toll Free Tel: 800-225-7814; Tel: 423-586-2265; or comparable products by one of the following.
 - 1. O'Keeffe's Inc.

- B. info@PrecisionLadders.com; Web: www.PrecisionLadders.com
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 ALUMINUM FIXED VERTICAL LADDER

- A. Aluminum Fixed Vertical Ladder and Components: Ladder, fall arrest system, floor mounting brackets, and finishes.
 - 1. Aluminum Fixed Vertical Ladder as manufactured by Precision Ladders LLC. Height see drawings.
 - 2. Capacity: Unit shall support a 1,500 lb (680 kg) loading without failure.
 - 3. Performance Standard: Units designed and manufactured to meet or exceed ANSI A14.3, OSHA 1910.23, OSHA 1910.28 and OSHA 1910.29.
- B. Components:
 - 1. Ladder Stringer: 2-1/2 inch by 1-1/16 inch by 1/8 inch (64 mm by 27 mm by 3 mm) extruded 6005-T5 aluminum channel. Pitch: 90 degrees.
 - 2. Ladder Tread: 2-1/4 inch by 3/4 inch by 1/4 inch (57 mm by 19 mm by 6 mm) extruded 6005-T5 aluminum with deeply serrated top surface.
 - 3. Ladder Mounting Bracket: 8-1/2 inch by 2 inch by 3 inch by 1/4 inch thick (216 mm by 51 mm by 76 mm by 6 mm) aluminum angle. Secure to CMU wall.
 - 4. Fall Arrest System: Complete system with rail, sleeves, and harness to limit any fall to 6 inches (152 mm). Removeable Post for Hatch Access Ladders with Fall Arrest System. Harness by others.

2.3 FABRICATION

- A. Completely fabricate ladder ready for installation before shipment to the site.

PART 3 EXECUTION

3.1 EXAMINATION

- A. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- B. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

3.2 INSTALLATION

- A. Install in accordance with approved submittals.

3.3 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.

B. Related Requirements:

1. Section 055100 "Metal Stairs" for steel tube railings associated with metal pan stairs.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe and Tube Railings: See performance requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

- A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 2 1/4"-inch clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 FASTENERS

- A. General: Provide the following:
1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
- B. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Intermediate Coat: Complying with Section 099600 "High-Performance Coatings."
- G. Topcoat: Complying with Section 099600 "High-Performance Coatings."
- H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- I. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION

- A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- B. Form work true to line and level with accurate angles and surfaces.
- C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove flux immediately.
 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

- D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- E. Form changes in direction by bending.
- F. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- G. Close exposed ends of railing members with prefabricated end fittings.
- H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- J. Picket Infill: Fabricate pickets from 3/4 inch square tube.
 - 1. Install at 4 inches o.c., welded to railings .

2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Do not apply primer to galvanized surfaces.
- E. High-Performance Coating: Apply intermediate and topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 4 inches deep or to full depth of concrete, whichever is lesser, and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members.

3.3 ATTACHING RAILINGS

- A. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
 - 4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

5. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood blocking, cants and nailers.
2. Wood furring and grounds.
3. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Powder-actuated fasteners.
7. Expansion anchors.
8. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency

certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal unless otherwise indicated.
- C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Lumber located in Roof construction.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Cants.
 - 4. Furring.
 - 5. Grounds.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine; No. 2 grade; SPIB.
 - 2. Eastern softwoods; No. 2 Common grade; NeLMA.
 - 3. Northern species; No. 2 Common grade; NLGA.

4. Western woods; Construction or No. 2 Common grade; WCLIB or WWP.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Power-Driven Fasteners: NES NER-272.
- C. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.7 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Cleveland Steel Specialty Co.
 2. KC Metals Products, Inc.
 3. Phoenix Metal Products, Inc.
 4. Simpson Strong-Tie Co., Inc.
 5. USP Structural Connectors.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds and similar supports to comply with requirements for attaching other construction.
- B. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- C. Do not splice structural members between supports unless otherwise indicated.
- D. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- E. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Rooftop equipment bases and support curbs.
4. Wood blocking, cants, and nailers.
5. Wood furring and grounds.
6. Plywood backing panels.

1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
- C. Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.
- D. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. RIS: Redwood Inspection Service.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Engineered wood products.
 4. Shear panels.
 5. Power-driven fasteners.
 6. Powder-actuated fasteners.
 7. Expansion anchors.
 8. Metal framing anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship" for the following:
1. Dimension lumber framing.
 2. Timber.
 3. Laminated-veneer lumber.
 4. Parallel-strand lumber.
 5. Prefabricated wood I-joists.
 6. Rim boards.
 7. Miscellaneous lumber.
- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece. Where not exposed to view.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.
- C. Maximum Moisture Content of Lumber: 19 percent.
- D. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat all rough carpentry unless otherwise indicated. Insert other items that require treatment but are not likely to be indicated on Drawings.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
1. Use treatment that does not promote corrosion of metal fasteners.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.4 DIMENSION LUMBER FRAMING

- A. No. 2 grade.

1. Species:
 - a. Mixed southern pine; SPIB.

2.5 TIMBER FRAMING

- A. Provide timber framing complying with the following requirements, according to grading rules of grading agency indicated:

1. Species and Grade: Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; No. 1 grade; NLGA, WCLIB, or WWPA.

2.6 ENGINEERED WOOD PRODUCTS

- A. Engineered Wood Products, General: Products shall contain no urea formaldehyde.
- B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- C. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Boise Cascade Corporation.
 - b. Finnforest USA.
 - c. Georgia-Pacific.
 - d. Jager Building Systems Inc.
 - e. Louisiana-Pacific Corporation.
 - f. Pacific Woodtech Corporation.
 - g. Roseburg Forest Products Co.
 - h. Standard Structures Inc.
 - i. Stark Truss Company, Inc.
 - j. West Fraser Timber Co., Ltd.
 - k. Weyerhaeuser Company.
- D. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

2.7 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
 - 7. Utility shelving.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.8 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.9 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- G. 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 assemblies 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 testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
- D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit.

Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.
- I. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- J. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.

- K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- M. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
 - 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
 - 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally and vertically at 24 inches (610 mm) 600 mm o.c.

- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) 400 mm o.c.

3.4 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
 - 1. Provide continuous horizontal blocking at midheight of partitions more than 96 inches (2438 mm) high, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal (89-mm actual) depth for openings 48 inches (1200 mm) and less in width, 6-inch nominal (140-mm actual) depth for openings 48 to 72 inches (1200 to 1800 mm) in width, 8-inch nominal (184-mm actual) depth for openings 72 to 120 inches (1800 to 3000 mm) in width, and not less than 10-inch nominal (235-mm actual) depth for openings 10 to 12 feet (3 to 3.6 m) in width.
 - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches (1500 mm) and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated or, if not indicated, according to Table R502.5(1) or Table R502.5(2), as applicable, in ICC's International Residential Code for One- and Two-Family Dwellings.

3.5 TIMBER FRAMING INSTALLATION

- A. Install timber with crown edge up and provide not less than 4 inches (102 mm) of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.
- B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch (13-mm) air space at sides and ends of wood members.
- C. Install wood posts using metal anchors indicated.
- D. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

3.6 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory." or GA-600, "Fire Resistance Design Manual."

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Gypsum LLC; 5/8" DensGlass exterior sheathing or comparable product by one of the following:
 - a. Certaiteed.
 - b. James Hardie Building Products, Inc.
 - c. National Gypsum Company.
 - d. United States Gypsum Company.+

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

- B. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior plywood paneling.
2. Closet shelving and clothes rods.
3. Interior wood railings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
- B. Samples: For each type of paneling.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - a. For exposed lumber, mark grade stamp on end or back of each piece.

B. Softwood Plywood: DOC PS 1.

2.2 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1, made without urea-formaldehyde adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one manufacturer:
 1. Face Grade: HPVA grade AA.
 2. Back Grade: HPVA grades 1 or 2.
 3. Face Veneer Cut: Rotary-cut white birch, Rotary-cut red oak or Rotary-cut white oak, as selected by Architect.
 4. Panel Face Veneer Matching: Whole piece veneer.
 5. Thickness: 1/2 inch.
 6. Finish: Stain as per Section 099300 "Staining and Transparent Finishing."

7. Metal Reveal Trim: As manufactured by Fry Reglet or equal.
 - a. Vertical Trim: Fry Reglet MWR5050
 - b. Inside Corner Trim: Fry Reglet MWCISC50
 - c. Outside Corner Trim: Fry Reglet MWCK50
 - d. Mounting Accessories: Provide all mounting accessories, as necessary for a complete installation and as recommend by manufacturer.
 - e. Finish: Clear anodized or color anodized, as selected by Architect from manufacturer's full range of standard colors.

2.3 CLOSET SHELVING AND CLOTHES RODS

- A. Shelving: Made from the following material, 3/4 inch thick.
 1. Softwood Boards: Douglas fir-larch, Douglas fir south, or hem-fir; Superior or C & Btr finish; NLGA, WCLIB, or WWPA; or southern pine, B & B finish; SPIB; kiln dried.
- B. Shelf Cleats: 3/4-by-5-1/2-inch boards with hole and notch to receive clothes rods, as specified above for shelving.
- C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.
- D. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.
- E. Clothes Rods: 1-1/2-inch diameter, clear, kiln-dried Douglas fir or southern pine.

2.4 WOOD RAILINGS

- A. Interior Railings: Clear, kiln-dried red oak.
 1. Finish: Stain as per Section 099300 "Staining and Transparent Finishing."

2.5 STAGE FLOOR

Structural-Floor: 3/4" x 4' x 8' APA rated Sturdi-Floor tongue and groove pine plywood over Sound-Deadening Board: Blue Ridge Fiberboard 250 Celotex Dr. Danville, VA. 24541 over 3/4" x 4' x 8' pine plywood.

2.6 MISCELLANEOUS MATERIALS

- A. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
 1. Wood glue shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.
 1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer.

3.2 INSTALLATION, GENERAL

- A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

3.3 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. [Cope] [Miter] at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.

3.4 PANELING INSTALLATION

- A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.
 - 1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners and adhesive as recommended by panel manufacturer.
 - 2. Conceal fasteners to greatest practical extent.
- B. Hardboard Paneling: Install according to manufacturer's written recommendations. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Butt adjacent panels with moderate contact. Use fasteners with prefinished heads matching paneling color.
- C. Board Paneling: Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.
 - 1. Install in full lengths without end joints.
 - 2. Stagger end joints in random pattern to uniformly distribute joints on each wall.

3. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards. Install with uniform tight joints between boards.
4. Fasten paneling by face nailing, setting nails, and filling over nail heads.
5. Fasten paneling with trim screws, set below face and filled.
6. Fasten paneling by blind nailing through tongues.

3.5 SHELVING AND CLOTHES ROD INSTALLATION

- A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.
- B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches o.c.
- C. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- D. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.

3.6 RAILING INSTALLATION

- A. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts, and glue. Assemble railings at goosenecks, easements, and splices with rail bolts and glue.

END OF SECTION 062023

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Plastic-laminate-faced shelving.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 123623.13 "Plastic-Laminate-Clad Countertops."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate and cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples:
 1. Plastic laminates, for each color, pattern, and surface finish.
 2. Thermoset decorative panels, for each color, pattern, and surface finish.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: 5 years documented experience in the successful fabrication of plastic-laminate-faced architectural cabinets for commercial building projects.
- B. Installer Qualifications: Fabricator of products.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET FABRICATORS

- A. Fabricators: Subject to compliance with requirements, provide products by one of the following:
1. Insight Inc. Cooktown Road, Ruston, LA 318-255-8789
 2. Tippen's Specialty Millwork 211 Hood Street, West Monroe, LA 318-387-5973
 3. Bayou Wood Products 1315 Hwy 15, West Monroe, LA 318-397-0000
 4. Douglas Cabinet Company.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
1. Basis of Design: Subject to compliance with requirements, provide Formica Corporation 1.800.367.6422 or comparable products by one of the following:
 - a. Abet Laminati, Inc.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Panolam Industries International, Inc.
 - e. Wilsonart International; Div. of Premark International, Inc.
 - f. Nevamar.
- F. Laminate Cladding for Exposed Surfaces:
1. Horizontal Surfaces: Grade HGS.
 2. Postformed Surfaces: Grade HGP.
 3. Vertical Surfaces: Grade HGS.
 4. Pattern Direction: As requested by Architect.
- G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 3. Drawer Bottoms: Thermoset decorative panels.
- H. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated by laminate manufacturer's designations.
 2. Match Architect's sample.
 3. As selected by Architect from laminate manufacturer's full range in the following categories. Furnish color samples of both gloss and matte finishes for architects selection.
 - a. Solid colors, gloss or matte finish.
 - b. Solid colors with core same color as surface, gloss or matte finish.
 - c. Wood grains, gloss or matte finish.
 - d. Patterns, gloss or matte] finish.
 - e. Several colors and finishes will be selected by Architect. See interior elevations on drawings.

2.3 PLASTIC-LAMINATE-FACED SHELVING

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate shelves indicated for construction, finishes, installation, and other requirements.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
1. Basis of Design: Subject to compliance with requirements, provide Formica Corporation 1.800.367.6422 or comparable products by one of the following:
 - a. Abet Laminati, Inc.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Panolam Industries International, Inc.
 - e. Wilsonart International; Div. of Premark International, Inc.
 - f. Nevamar.
- E. Laminate Cladding for Exposed Surfaces:
1. Horizontal Surfaces: Grade HGS.

2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade VGS.
4. Pattern Direction: As requested by Architect.

F. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermoset decorative panels.

G. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard is not allowed.

H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by laminate manufacturer's designations.
2. Match Architect's sample.
3. As selected by Architect from laminate manufacturer's full range in the following categories: Furnish color samples of both gloss and matte finishes for architects selection.
 - a. Solid colors, gloss or matte finish.
 - b. Solid colors with core same color as surface, gloss or matte finish.
 - c. Wood grains, gloss or matte finish.
 - d. Patterns, gloss or matte finish.
 - e. Several colors and finishes will be selected by Architect. See interior elevations on drawings.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
2. Softwood Plywood: DOC PS 1, medium-density overlay.
3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
4. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.5 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch thick metal, and as follows:
 - 1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
 - 2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, [170] degrees of opening[, self-closing].
- D. Back-Mounted Pulls: BHMA A156.9, B02011.
- E. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- F. Catches: Magnetic catches, BHMA A156.9, B03141.
- G. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- H. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- I. Drawer Slides: BHMA A156.9.
 - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; [full-extension type; zinc-plated steel with polymer rollers.
 - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
 - 3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
 - 4. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
 - 5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
 - 6. For computer keyboard shelves, provide Grade 1.
 - 7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100.
- J. Door Locks: BHMA A156.11, E07121.
- K. Drawer Locks: BHMA A156.11, E07041.
- L. Door and Drawer Silencers: BHMA A156.16, L03011.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match Architect's sample.
 - 2. Bright Brass, Clear Coated: BHMA 605 for brass base; BHMA 632 for steel base.

3. Bright Brass, Vacuum Coated: BHMA 723 for brass base; BHMA 729 for zinc-coated-steel base.
4. Satin Brass, Blackened, Bright Relieved, Clear Coated: BHMA 610 for brass base; BHMA 636 for steel base.
5. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
6. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.
7. Satin Stainless Steel: BHMA 630.

2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.7 FABRICATION

- A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with custom grade as item to be installed.

- B. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- D. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
- E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips, No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish or No. 10 wafer-head, self-drilling screws sized for not less than 1-1/2-inch penetration into concrete masonry units, blocking, or hanging strips

END OF SECTION 064116

SECTION 071900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:
 - 1. Clay brick masonry (face brick).

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of water repellent and substrate indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

- A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOCs.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals, LLC; MasterProtect H 177.
 - b. Euclid Chemical Company (The), an RPM company; Chemstop WB Regular/Heavy Duty.
 - c. PROSOCO, Inc.; Siloxane PD or Siloxane WB Concentrate.
 - d. SaverSystems; MasonrySaver Water Repellent for Brick.
 - e. Sika Corporation, Inc.; Sikagard 701W.
 - f. Tnemec Inc.; Dur A Pell 10.

PART 3 - EXECUTION

3.1 General

- A. Apply water repellent to all vertical and horizontal surfaces of the following materials, exposed to the exterior:

1. Clay brick masonry (face brick / thin brick)

3.2 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in representative locations by method recommended by manufacturer.
 2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
 3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 4. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

3.3 PREPARATION

- A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.
- B. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- C. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.4 APPLICATION

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using low-pressure spray to the point of saturation. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
 1. Precast Concrete and Cast Stone: At Contractor's option, first application of water repellent on units may be completed before installing them. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces.

- C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.5 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application.
- B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.
2. Mineral-wool blanket insulation.
3. Spray polyurethane foam insulation @ CMU walls
4. 1 ½" extruded polystyrene unfaced insulation bd.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 RIGID INSULATION BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.

1. Owens Corning
2. Johns Manville
3. Knauf Insulation
4. CertainTeed Corporation

- B. Extruded Polystyrene (XPS) Cavity Wall Insulation Board: Complies with [ASTM C578](#), and manufactured using carbon black technology.

Type and Compressive Resistance: **Type IV, 25 psi (173 kPa)**, minimum.

Flame Spread Index (FSI): **Class A - 0 to 25**, when tested in accordance with [ASTM E84](#).

Smoke Developed Index (SDI): 450 or less, when tested in accordance with [ASTM E84](#).

Type and Thermal Resistance, **R-value (RSI-value): Type IV, 5.6 (0.98)**, minimum, **per 1 inch (25.4 mm)** thickness at **75 degrees F (24 degrees C)** mean temperature.

Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with [NFPA 285](#).

Board Size: **15-3/4 inches by 96 inches.**

Board Thickness: **1 1/2 inches.**

Board Edges: **Square**

Type and Water Absorption: **Type IV, 0.3** percent by volume, maximum, by total immersion.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. **CertainTeed Corporation.**
2. **Guardian Building Products, Inc.**
3. **Johns Manville.**
4. **Knauf Insulation.**
5. **Owens Corning.**

- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Interior Partitions: Provide in unfaced, glass-fiber blanket insulation in stud cavity of interior partitions, as indicated by Drawings.
2. Exterior Walls: Provide in unfaced, glass-fiber blanket insulation in stud cavity of all exterior stud wall, as follows:
 - a. 3-5/8-inch Studs: 3-1/2 inches thick, R-13.
 - b. 6-inch Studs: 6 inches thick, R-19.
3. Ceiling insulation: Provide above all ceilings 6" R-19 unfaced Batt insulation.

2.3 CONCRETE MASONRY UNIT (CMU) INSULATION

- A. Foam Fill Insulation: Foamed-in-place aminoplast foam insulation, Class A building material with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84, minimum R-Value of 4.0 per inch, minimum Dry-Density of 0.7lbs per cubic foot and minimum Wet-Density of 2.5lbs per cubic foot.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. **Tailored Chemical Products, Inc.; Core-Fill 500**
 - b. **cfiFOAM, Inc.; Core Foam**
2. Basis-of-design product: Tailored Chemical Products, Inc.; Core-Fill 500

2.4 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation.
 - b. BaySystems NorthAmerica, LLC.
 - c. Dow Chemical Company (The).
 - d. Gaco Western Inc.
 2. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
 3. Provide polyurethane foam insulation manufacturer's standard Thermal Barrier coating, complying with the International Building Code, 2012 edition.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF INSULATION BELOW STEEL DECK

- A. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts and conduits scheduled to be surface mounted to deck is completed, electrical boxes, and other items not indicated to receive insulation are masked.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

END OF SECTION 072100

SECTION 072130 – HIGH PERFORMANCE INSULATION & FINISH SYSTEM
(Simple Saver Insulation System)**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Pre-Engineered Building Insulation for New Construction.
- B. Pre-Engineered Building Insulation for Existing Construction.

1.2 RELATED SECTIONS

- A. Section 133419 - Pre-Engineered Metal Buildings
- B. Division 23 - Mechanical; Rough-in utilities.
- C. Division 26 - Electrical; Rough-in utilities.

1.3 REFERENCES

- A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials in Sheet Form (Procedure B).
- C. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- E. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- F. ASTM C 1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

1.4 DESIGN REQUIREMENTS

- A. Thermal Resistance of Installed System: R-Value of 30 Simple Saver System R-19 and R-11 for a total of R-30.
- B. Insulating system shall have a continuous vapor barrier inside of building purlins, girts, and insulation to provide complete isolation from inside conditioned air.

1.5 SUBMITTALS

- A. Submit under provisions of Section 013000.

- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation instructions.
- C. Shop Drawings: Indicate locations of connections and attachments, general details, anchorages and method of anchorage and installation.
- D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square or long, representing actual products required for this project.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing product systems specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing work of this section.
- C. Insulation system components to include a ten-year limited material warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products indoors and protect from moisture, construction traffic, and damage.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis Of Design: Thermal Design, Inc., Simple Saver System. P.O. Box 468, 601 N. Main Street, Madison, NE 68748. ASD. Tel: (800) 255-0776 or (402) 454-6591. Fax: (402) 454-2708. Email: sales@thermaldesign.com, www.thermaldesign.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 016000.

2.2 MATERIALS

- A. Simple Saver System consists of Batt Insulation, Roof Insulation, Wall Insulation, Vapor Barrier Liner Fabric, Thermal Breaks, Straps, and other devices and components in a proprietary insulation system as follows
1. Batt Insulation: ASTM C 991 Type 1; preformed formaldehyde-free glass fiber batt conforming to the following:
 - a. Thermal Resistance: R of 38.
 - b. Batt Size: Equal to purlin/girt spacing by manufacturer's standard lengths.
 - c. Unfaced.
 2. Roof Insulation: Formaldehyde-free fiberglass batt or fiberglass blanket complying with ASTM C 991 Type 1 and ASTM E 84 with a thermal resistance and thickness as follows:
 - a. As indicated on the drawings.
 3. Vapor Barrier Liner Fabric: Syseal® type woven, reinforced, high-density polyethylene yarns coated on both sides with a continuous white or colored polyethylene coatings, as follows:
 - a. Product complies with ASTM C 1136, Types I through Type VI.
 - b. Perm rating: 0.02 for fabric and for seams in accordance with ASTM E 96.
 - c. Flame/Smoke Properties:
 - 1) 25/50 in accordance with ASTM E 84.
 - 2) Self-extinguishes with field test using matches or butane lighter.
 - d. Ultraviolet radiation inhibitor to minimum UVMAX® rating of 8.
 - e. Size and seaming: Manufactured in large custom pieces by extrusion welding from roll goods and fabricated to substantially fit defined building area with minimum practicable job site sealing.
 - f. Provide with factory double, extrusion welded seams. Stapled seams or heat-melted seams are not acceptable due to degradation of fabric.
 - g. Factory-folded to allow for rapid installation.
 - h. Color: To Be Selected by Architect / Owner.
 - 1) White.
 - 2) Super white.
 - 3) Gray.
 - 4) Black.
 - 5) Silver aspen.
 - 6) Custom color to be available as selected by Architect
 4. Vapor Barrier Lap Sealant: Solvent-based, Simple Saver polyethylene fabric adhesive.
 5. Vapor Barrier Tape: Double-sided sealant tape 3/4 inch (19 mm) wide

- by 1/32 inch (.79 mm) thick.
6. Vapor Barrier Patch Tape: Single-sided, adhesive backed sealant tape 3 inches (76 mm) wide made from same material as Syseal® type liner fabric.
 7. Thermal Breaks:
 - a. 1/8 inch (3 mm) thick by 3 inch (76 mm) wide white, closed-cell polyethylene foam with pre-applied adhesive film and peel-off backing.
Polystyrene Snap-R snap-on thermal blocks.
 8. Straps:
 - a. 100 KSI minimum yield tempered, high-tensile-strength steel.
 - b. Size: Not less than 0.020 inch (0.50 mm) thick by 1 inch (25 mm) by continuous length.
 - c. Galvanized, primed, and painted to match specified finish color on the exposed side.
 - d. Color:
 - 1) White.
 - 2) Gray.
 - 3) Silver Aspen.
 - 4) Custom Color.
 - e. Primed and painted to match specified finish color on the exposed side.
 - f. Color:
 - 1) Black.
 - 2) Custom Color.
 - g. High-tensile-strength stainless steel.
 - h. Woven polyester plastic. Color as selected.
 9. Fasteners:
 - a. For light gage steel: #12 by 3/4 (19 mm) inch plated Tek 2 type screws with sealing washer, painted to match specified color.
 - b. For heavy gage steel: #12 by 1-1/2 inch (38 mm) plated Tek 4 type screws with sealing washer, painted to match specified color.
 - c. For wood, concrete, other materials: As recommended by manufacturer.
 10. Wall Insulation Hangers: Fast-R preformed rigid hangers, 32 inch (813 mm) long galvanized steel strips with barbed arrows every 8 inches (203 mm) along its length.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that building structure including all bracing and any concealed building systems are completed and approved prior to installing liner system and insulation in the structure.
- B. Correct any unsatisfactory conditions before proceeding.
- C. If conditions are the responsibility of another installer, notify

Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION - GENERAL

- A. Install pre-engineered building insulation system in accordance with manufacturer's installation instructions and the approved shop drawings.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install in exterior spaces without gaps or voids. Do not compress insulation.
- D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- E. Fit insulation tight in spaces and tight to exterior side of the sealed liner fabric and around mechanical and electrical services within plane of insulation.

3.3 ROOF INSULATION INSTALLATION

- A. Straps:
 - 1. Cut straps to length and install in the pattern and spacings indicated on shop drawings.
 - 2. Tension straps to required value
- B. Vapor Barrier Fabric:
 - 1. Install vapor barrier fabric in large one-piece custom fabricated pieces to substantially fit defined building areas with minimum practicable job site sealing.
 - 2. Position pre-folded fabric on the strap platform along one eave purlin.
 - 3. Clamp the two bottom corners at the eave and also centered on the bay.
 - 4. Pull the other end of the pleat-folded fabric across the building width on the strap platform, pausing only at the ridge to fasten the straps and fabric in position where plane of roof changes and to release temporary fasteners on the opposite ridge purlins.
 - 5. Once positioned, install fasteners from the bottom side at each strap/purlins intersection.
 - 6. Trim edges and seal along the rafters.
 - 7. All seams must be completely sealed and stapled seams not acceptable.
- C. Insulation:
 - 1. Unpack, and shake to a thickness exceeding the specified thickness.
 - 2. Ensure that cavities are filled completely with insulation.
 - 3. Place on the vapor barrier liner fabric without voids or gaps.
 - 4. Place top layer of insulation over and perpendicular to the purlins without voids or gaps, as roof sheathing is applied.
 - 5. Place thermal block on top of purlins or bottom of purlins for retrofit work, if no other thermal break exists.
 - 6. Place new insulation between purlins at the required thickness for the R-value specified.
- D. Seal vapor barrier fabric to the wall fabric and elsewhere as required to provide a continuous vapor barrier

3.4 WALL INSULATION INSTALLATION

- A. Insulation:
 - 1. Install thermal break to exterior surface of girts as wall sheathing is applied.
 - 2. (Optional) Install self-sticking foam thermal break to interior surface of girts prior to installation of insulation.
 - 3. Position and secure Fast-R hangers to girts on the inside face of the wall sheathing.
 - 4. Cut insulation to required lengths to fit vertically between girts.
 - 5. Fluff the insulation to the full-specified thickness.
 - 6. Neatly position in place and secure to Fast-R hangers.
 - 7. Ensure that cavities are filled completely with insulation.
- B. Vapor Barrier Fabric:
 - 1. Install vapor barrier fabric in large one-piece custom fabricated pieces to substantially fit defined building areas with minimum practicable job site sealing.
 - 2. Apply the vapor barrier fabric by clamping it in position over eave strap and installing fasteners through the eave strap into each roof strap, permanently clamping the wall fabric between them.
 - 3. Once in position, draw the vapor barrier fabric down over the column flanges to the base angle and install vertical straps along each column and 5 feet 0 inches on center, maximum, fastening to each girt to retain system permanently in place.
 - 4. All seams must be completely sealed and stapled seams not acceptable.
- C. Seal wall fabric to the roof fabric, to the base angle and up the columns to provide a continuous vapor barrier.

3.5 CLEANING

- A. Clean dirt or exposed sealant from the exposed vapor barrier fabric.
- B. Remove scraps and debris from the site.

3.6 PROTECTION

- A. Protect system products until completion of installation.
- B. Repair or replace damaged products before completion of insulation system installation.

3.7 SCHEDULE

- A. Ceiling Insulation general: R-30.

END OF SECTION

SECTION 07 22 00**ROOF INSULATION****PART 1 GENERAL****1.01 SUMMARY**

- A. Work shall include, but is not limited to, the following:
 - 1. Preparation of new flat and sloped steel roof deck and all flashing substrates.
 - 2. Insulation
 - 3. Cover-board
 - 4. All related materials and labor required to complete specified roofing necessary to receive specified manufacturer's warranty.

1.02 RELATED SECTIONS

- A. Division 010000 – General Requirements
- B. Division 011000 – Summary of Work
- C. Division 071416 – Cold Fluid-Applied Waterproofing
- D. Division 075419 – Polyvinyl-Chloride (PVC) Roofing
- E. Division 076200 – Sheet Metal Flashing and Trim

1.03 DEFINITIONS

- A. ASTM D 1079-Definitions of Term Relating to Roofing and Waterproofing.
- B. The National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual, Fifth Edition Glossary.

1.04 REFERENCES

- A. AMERICAN SOCIETY OF CIVIL ENGINEERS - Reference Document ASCE 7, Minimum Design Loads for Buildings and Other Structures.
- B. AMERICAN STANDARD OF TESTING METHODS (ASTM):
 - 1. ASTM C 726 - Standard Specification for Mineral Wool Roof Insulation Board.
 - 2. ASTM C 728 - Standard Specification for Perlite Thermal Insulation Board.
 - 3. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 4. ASTM C 1278 - Standard Specification for Fiber-Reinforced Gypsum Panel.
 - 5. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Insulation Board.
 - 6. ASTM C 1325 – Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
 - 7. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing.
- C. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)::

1. ANSI/SPRI FX-1, Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
2. ANSI/SPRI IA-1, Standard Field Test Procedure for Determining the Mechanical Uplift Resistance of Insulation Adhesives over Various Substrates.
3. ANSI/FM 4474- American National Standard for Evaluating the Simulated Wind Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures.
- D. CANADIAN GENERAL STANDARDS BOARD (CGSB):
 1. CGSB 37-GP 56M- Standard for: Modified Bituminous, Prefabricated, and Reinforced for Roofing.
- E. FACTORY MUTUAL (FM):
 1. FM 4450 - Approval Standard - Class I Insulated Steel Roof Decks.
 2. FM 4470 - Approval Standard - Class I Roof Covers.
- F. FLORIDA BUILDING CODE (FBC):
 1. 2021 Florida Building Code (FBC).
- G. INTERNATIONAL CODES COUNCIL (ICC):
 1. 2021 International Building Code (IBC).
- H. NATIONAL ROOFING CONTRACTORS' ASSOCIATION (NRCA).
- I. UNDERWRITERS LABORATORY (UL):
 1. UL 790 Standard Test Methods for Fire Tests of Roof Coverings.
 2. UL 1256 – Fire Test of Roof Deck Constructions.

1.05 ACTION SUBMITTALS

- A. Product Data Sheets: Submit manufacturer's product data sheets, installation instructions and/or general requirements for each component.
- B. Safety Data Sheets: Submit manufacturer's Safety Data Sheets (SDS) for each component.
- C. Sample/Specimen Warranty from the manufacturer and contractor.
- D. Shop Drawings: Provide roof plan and applicable roof system detail drawings.

1.06 INFORMATIONAL SUBMITTALS

- A. Contractor Certification: Submit written certification from roofing system manufacturer certifying that the applicator is authorized by the manufacturer to install the specified materials and system.

1.07 CLOSEOUT SUBMITTALS

- A. Warranty: Provide manufacturers and contractor's warranties upon substantial completion of the roofing system.

1.08 QUALITY ASSURANCE

- A. MANUFACTURER QUALIFICATIONS:
 1. Manufacture shall have 20 years of experience manufacturing roofing materials.
 2. Trained Technical Field Representatives, employed by the manufacturer, independent of sales.
 3. Provide reports in a timely manner of all site visit reports.

4. Provide specified warranty upon satisfactory project completion.
- B. CONTRACTOR QUALIFICATIONS:
 1. Contractor shall be authorized by the manufacturer to install specified materials prior to the bidding period through satisfactory project completion.
 2. Applicators shall have completed projects of similar scope using same materials as specified herein.
 3. Contractor shall provide full time, on-site superintendent or foreman experienced with the specified roof system through satisfactory project completion.
 4. Applicators shall be skilled in the application methods for all materials.
 5. Contractor shall maintain a daily record, on-site, documenting material installation and related project conditions.
 6. Contractor shall maintain a copy of all submittal documents, on-site, available always for reference.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Refer to each product data sheet or other published literature for specific requirements.
- B. Deliver materials and store them in their unopened, original packaging, bearing the manufacturer's name, related standards, and any other specification or reference accepted as standard.
- C. Protect and store materials in a dry, well-vented, and weatherproof location. Only materials to be used the same day shall be removed from this location.
- D. When materials are to be stored outdoors, store away from standing water, stacked on raised pallets or dunnage, at least 4 in or more above ground level. Carefully cover storage with "breathable" tarpaulins to protect materials from precipitation and to prevent exposure to condensation.
- E. Properly dispose of all product wrappers, pallets, cardboard tubes, scrap, waste, and debris. All damaged materials shall be removed from job site and replaced with new, suitable materials.

1.10 SITE CONDITIONS

- A. SAFETY:
 1. The contractor shall be responsible for complying with all project-related safety and environmental requirements.
 2. Refer to NRCA CERTA recommendations, local codes and building owner's requirements for hot work operations.
 3. The contractor shall review project conditions and determine when and where conditions are appropriate to utilize the specified liquid-applied, or semi-solid roofing materials. When conditions are determined by the contractor to be unsafe or undesirable to proceed, measures shall be taken to prevent or eliminate the unsafe or undesirable exposures and conditions, or equivalent approved materials and methods shall be utilized to accommodate requirements and conditions.
 4. The contractor shall review project conditions and determine when and where conditions are appropriate to utilize the specified hot asphalt-applied materials. When conditions are determined by the contractor to be unsafe or undesirable to proceed, measures shall be taken to prevent

or eliminate the unsafe or undesirable exposures and conditions, or equivalent approved materials and methods shall be utilized to accommodate requirements and conditions.

5. The contractor shall refer to product Safety Data Sheets (SDS) for health, safety, and environment related hazards, and take all necessary measures and precautions to comply with exposure requirements.

B. ENVIRONMENTAL CONDITIONS:

1. Monitor substrate temperature and material temperature, as well as all environmental conditions such as ambient temperature, moisture, sun, cloud cover, wind, humidity, and shade. Ensure conditions are satisfactory to begin work and ensure conditions remain satisfactory during the installation of specified materials. Materials and methods shall be adjusted as necessary to accommodate varying project conditions. Materials shall not be installed when conditions are unacceptable to achieve the specified results.
2. Precipitation and dew point: Monitor weather to ensure the project environment is dry before, and will remain dry, during the application of roofing materials. Ensure all roofing materials and substrates remain above the dew point temperature as required to prevent condensation and maintain dry conditions.
3. Mopping asphalt application: Primer, where used, shall be fully dry before applying hot asphalt. Take all necessary measures and monitor all conditions, to ensure the specified asphalt temperature is no less than 400°F (204°C) at the point of contact with the specified membrane as it is rolled into the hot asphalt.

1.11 PERFORMANCE REQUIREMENTS

A. FIRE CLASSIFICATION:

1. Roof construction performance testing shall be in accordance with UL 1256, FM 4450, or FM 4470 to meet the specified requirements for interior flame spread and fuel contribution.
 - a. Roof construction meets requirements of UL 1256, or FM Class 1.

B. ROOF SLOPE:

1. Finished roof slope shall be ¼-inch per foot minimum for roof drainage.
- 2.

C. ENERGY CONSERVATION REQUIREMENTS:

1. Polyisocyanurate Insulation "R" Value: Long-term thermal resistance (LTTR) values of the specified foam insulation shall be determined in accordance with CAN/ULC-S770.
2. Polyisocyanurate Insulation "R" Value: Shall be determined in accordance with ASTM C1289-11a.
3. Thermal Resistance 'R' for the specified roof insulation system shall include the continuous insulation (ci) above the roof deck.
 - a. Total Thermal Resistance R Value, continuous insulation (ci) above-deck: minimum R-25.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. SINGLE SOURCE MANUFACTURER: All roofing materials shall be provided by a single supplier with 20 years or more manufacturing history in the US.
 - 1. Comply with the Manufacturer's requirements as necessary to provide the specified warranty.
- B. PRODUCT QUALITY ASSURANCE PROGRAM: Manufacturer shall be an ISO 9001 registered company.
- C. ACCEPTABLE MANUFACTURER:
 - 1. Soprema
 - 2. Siplast
 - 3. Prior Approved Equal

2.02 ROOFING SYSTEM

2.03 THERMAL INSULATION SYSTEM

- A. RIGID INSULATION
 - 1. POLYISOCYANURATE INSULATION:
 - a. Closed cell polyisocyanurate foam core bonded on each side to a glass fiber-reinforced felt facer.
 - i Thickness: 1.5 in minimum board thickness. Total thickness to meet specified insulation system thermal resistance 'R' value (2 layers of 2.2 on sloped Steel Deck)
 - ii Dimensions: 4 x 8 foot boards
 - iii Meets or exceeds ASTM C1289, Type II, Class 1, Grade 2 (20 psi)
 - b. Tapered: Closed cell polyisocyanurate foam core bonded on each side to a glass fiber-reinforced felt facer, tapered to provide slope.
 - i Taper: 1/4 in with 1/2 in crickets per foot. Insulation, crickets, and saddles provided with taper as required for positive roof slope.
 - ii Dimensions: 4 x 4 ft boards
 - iii Meets or exceeds ASTM C1289, Type II, Class 1, Grade 2 (20 psi)
- B. COVER-BOARD
 - 1. GYPSUM ROOF BOARD
 - a. National Gypsum Company, DEXcell FA Glass Mat Roof Board:
 - i Gypsum core, glass fiber-faced, roof board:
 - ii Thickness: 1/2 in
 - iii Dimensions: 4 x 8 ft boards
 - iv Facer: Glass fiber.
 - v Meets or exceeds ASTM C1177/C1177M.
 - b. Georgia Pacific Gypsum LLC, DensDeck Prime Roof Board:
 - i Gypsum core, glass fiber-faced, factory primed, roof Cover-board.
 - ii Thickness: 1/2 in
 - iii Dimensions: 4 x 8 ft boards
 - iv Facer: Factory primed, glass fiber.
 - v Meets or exceeds ASTM C1177/C1177M.
- C. INSULATION TAPERED STRIP
 - 1. TAPERED EDGE STRIP AND BOARDS:
 - a. Expanded perlite, blended with binders and fibers.

- i Dimensions: Size as required.
 - ii Meets or exceeds ASTM C728.
- D. INSULATION AND COVER BOARD ADHESIVE
 - 1. POLYURETHANE FOAM INSULATION ADHESIVE
 - a. Two-component, polyurethane foam insulation adhesive, applied in ribbons from cartridges or two-component bulk packaging with pump-driven delivery system.
 - i Ribbon size: 1/2 in to 3/4 in wide.
 - ii Ribbon spacing: As required to meet specified wind uplift resistance performance.
 - a) Field of Roof (Zone 1'): 12 in on-centers
 - b) Field of Roof (Zone 1): 12 in on-centers
 - c) Perimeter of Roof (Zone 2): 6 in on-centers
 - d) Corners of Roof (Zone 3): 4 in on-centers
 - b. Two-component, polyurethane foam insulation adhesive, applied in ribbons from two-component compressed cylinders.
 - i Ribbon size: 2-1/2 to 3-1/2 in wide.
 - ii Ribbon spacing: As required to meet specified wind uplift resistance performance.
 - a) Field of Roof (Zone 1'): 12 in on-centers
 - b) Field of Roof (Zone 1): 12 in on-centers
 - c) Perimeter of Roof (Zone 2): 6 in on-centers
 - d) Corners of Roof (Zone 3): 4 in on-centers

2.04 ACCESSORIES

- A. INSULATION FASTENERS AND PLATES
 - 1. #14 FASTENER and 3 IN INSULATION PLATE: Insulation system fasteners and metal stress plates.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examination includes visual observations, qualitative analysis, and quantitative testing measures as necessary to ensure conditions remain satisfactory throughout the project.
- B. Conduct qualitative insulation adhesive adhesion tests, or quantitative bonded pull tests as necessary to ensure satisfactory adhesion is achieved.
- C. The contractor shall examine all roofing substrates including, but not limited to: insulation materials, roof decks, walls, curbs, rooftop equipment, fixtures, and wood blocking.
- D. The applicator shall not begin installation until conditions have been properly examined and determined to be clean, dry and, otherwise satisfactory to receive specified roofing materials.
- E. During the application of specified materials, the applicator shall continue to examine all project conditions to ensure conditions remain satisfactory to complete the specified roofing system.

3.02 PREPARATION

- A. Before commencing work each day, the contractor shall prepare all roofing substrates to ensure conditions are satisfactory to proceed with the installation of specified roofing materials. Preparation of substrates includes, but is not limited to, substrate repairs, securement of substrates, eliminating all incompatible materials, and cleaning.
- B. Where conditions are found to be unsatisfactory, work shall not begin until conditions are made satisfactory to begin work. Commencing of work shall indicate contractor's acceptance of conditions.

3.03 INSULATION FASTENER APPLICATION

- A. Fasten Insulation Base Layer to the deck using specified insulation fasteners and plates.
- B. Evenly distribute fasteners as required by the board manufacturer's published requirements.
- C. Fasten the insulation to meet the specified wind uplift resistance performance requirements and warranty requirements.
- D. Minimum insulation fastening requirement:
 - 1. Field of Roof (Zone 1'): 16 fasteners per 4x8 ft board.
 - 2. Field of Roof (Zone 1): 16 fasteners per 4x8 ft board.
 - 3. Perimeter of Roof (Zone 2): 24 fasteners per 4x8 ft board.
 - 4. Corners of Roof (Zone 3): 32 fasteners per 4x8 ft board.
- E. For insulation and Cover-boards located partially within the defined perimeter and/or corners, install fastening for the entire board as specified herein.

3.04 INSULATION ADHESIVE APPLICATION

- 1. Apply the specified two-component insulation adhesive to adhere Insulation Layers and Cover-board to the deck and insulation substrate(s).
- 2. Follow insulation adhesive product data sheets and published general requirements for installation requirements.
- 3. Apply insulation adhesive in uniform ribbons, 1/2 in to 3/4 in wide.
- 4. Immediately install insulation components into insulation adhesive and apply weight to ensure the materials maintain full contact with all ribbons for complete adhesion. Do not allow insulation adhesive to skin-over before placing the insulation materials into the adhesive.
- 5. Adhere the insulation system to meet the specified wind uplift resistance performance and specified warranty requirements.
- 6. Minimum insulation adhesive ribbon spacing:
 - a. Field of Roof (Zone 1'): 12 in on-centers.
 - b. Field of Roof (Zone 1): 12 in on-centers.
 - c. Perimeter of Roof (Zone 2): 6 in on-centers.
 - d. Corners of Roof (Zone 3): 4 in on-centers.

INSULATION ADHESIVE PRESSURIZED CANNISTERS

- 7. Apply the specified two-component insulation adhesive to adhere Insulation Layers and Cover-board to the deck and insulation substrate(s).
- 8. Follow insulation adhesive product data sheets and published general requirements for installation requirements.
- 9. Apply insulation adhesive in uniform ribbons, 2-1/2 to 3-1/2 in wide.

10. Install insulation components into insulation adhesive and apply weight to ensure the materials maintain full contact with all ribbons for complete adhesion. Do not allow insulation adhesive to skin-over before placing the insulation materials into the adhesive.
11. Adhere the insulation system to meet the specified wind uplift resistance performance and specified warranty requirements.
12. Minimum insulation adhesive ribbon spacing:
 - a. Field of Roof (Zone 1'): 12 in on-centers.
 - b. Field of Roof (Zone 1): 12 in on-centers.
 - c. Perimeter of Roof (Zone 2): 6 in on-centers.
 - d. Corners of Roof (Zone 3): 4 in on-centers.

3.05 INSULATION SYSTEM APPLICATION

- A. Follow insulation system component product data sheets, published general requirements and, approvals.
- B. Install all insulation system components on clean, dry, uniform and, properly prepared substrates.
- C. All insulation system boards shall be carefully installed and fitted against adjoining sheets to form tight joints.
- D. Insulation system boards that must be cut to fit shall be saw-cut or knife-cut in a straight line, not broken. Chalk lines shall be used to cut insulation components. Uneven or broken edges shall not be accepted. Remove dust and debris that develops during cutting operations.
- E. Stagger successive layers of insulation 12 in vertically and laterally to ensure board joints do not coincide with joints from the layers above and below.
- F. Crickets, saddles, and tapered edge strips shall be installed before installing Cover-boards.
- G. Install tapered insulation, saddles and crickets as required to ensure positive slope for complete roof drainage.
- H. Cover-boards shall be installed to fit tight against adjacent boards. When required by the Cover-board manufacturer, a uniform gap shall be provided between Cover-boards using a uniform guide placed between board joints to form a gap between all boards during installation.
- I. The finished insulation system surface shall be tight to, and flush with, adjacent substrates to form a satisfactory substrate to install specified roof membrane and flashings.
- J. Install specified cants where required for membrane flashing transitions.

3.06 CLEAN-UP

- A. Clean-up and properly dispose of waste and debris resulting from these operations each day as required to prevent damages and disruptions to operations.

END OF SECTION

SECTION 072726 - FLUID-APPLIED AIR & WATER-RESISTIVE BARRIER SYSTEM

PART 1 – GENERAL

1.1 SUMMARY:

- A. Work of this section includes window and door flashing, air and water-resistive barrier membrane system, and accessory materials for application to exterior building envelope substrates as indicated on the drawings.
- B. Related work:
 - 1. Concrete.
 - 2. Masonry.
 - 3. Sheathing.
 - 4. Exterior wall finish materials.
 - 5. Flashings.
 - 6. Joint sealants.
 - 7. Doors and frames.
 - 8. Storefronts.
 - 9. Curtain walls.
 - 10. Windows.
 - 11. Stucco.

1.2 PERFORMANCE REQUIREMENTS:

- C. Performance requirements: Comply with the specified performance requirements and characteristics as herein specified.
- D. Performance description:
 - 1. The building envelope shall be constructed with a continuous, air and water-resistive barrier to control water and air leakage into and out of the conditioned space.
 - 2. Joints, penetrations and paths of water and air infiltration shall be made watertight and airtight.
 - 3. System shall be capable of withstanding positive and negative combined wind, stack and HVAC pressures on the envelope without damage or displacement.
 - 4. System shall be installed in an airtight and flexible manner, allowing for the relative movement of systems due to thermal and moisture variations.

1.3 SUBMITTALS:

- E. Product data: Submit manufacturer's product data including membrane and accessory material types, technical and test data, composition, descriptions and properties, installation instructions and substrate preparation requirements.
- F. Shop Drawings: Provide Installation Guideline Illustrations. Submittals shall be submitted to the Architect electronically.

1.4 QUALITY ASSURANCE:

- G. Applicable standards, as referenced herein: ASTM International (ASTM).

- H. Manufacturer's qualifications: Air and water-resistive barrier systems shall be manufactured and marketed by a firm with a minimum of ten (10) years experience in the production and sales of air and water-resistive barrier system. Manufacturers proposed for use, but not named in these specifications, shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- I. Installer's qualifications: The installer shall demonstrate qualifications to perform the work of this section by submitting the following:
 - 1. Verification that installer has been trained by and is approved to perform work as herein specified by air and water-resistive barrier system manufacturer.
 - 2. A firm experienced in applying similar materials on similar size and scoped projects.
 - 3. Evidence of proper equipment and trained field personnel to successfully complete the project.
- J. Inspection and testing: Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover installed products or assemblies until they have been inspected, tested and approved.
- K. Sole source: Obtain materials from a single manufacturer.
- L. This material shall be installed behind all exterior finishes such as brick, block, EIFS, and metal panels, etc.
- M. Product shall be installed by a Louisiana Licensed Waterproofing Contractor.
- N. Regulations: Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOC).
- O. Install mock-up using approved weather barrier system including membrane, flashing, joint and detailing compound and related weather barrier accessories according to weather barrier manufacture's current printed instructions and recommendations.
 - 1. Mock-up shall be 10 feet by 10 feet and shall be inspected by the architect prior to work continuing.
 - 2. Mock-up substrate: Match wall assembly construction, including window opening.
 - 3. Mock-up may remain as part of the final work.
- P. Pre-installation conference: Prior to beginning installation of air and water-resistive barrier system, hold a pre-installation conference to review work to be accomplished.
 - 1. Contractor, Architect, installing subcontractor, membrane system manufacturer's representative, and all subcontractors who have materials penetrating membrane system or finishes covering membrane system shall be present.
 - 2. Contractor shall notify Architect at least seven days prior to time for conference.
 - 3. Contractor shall record minutes of meeting and distribute to attending parties.
 - 4. Agenda: As a minimum discuss:
 - a. Surface preparation.
 - b. Substrate condition and pretreatment.

- c. Minimum curing period.
- d. Special details and sheet flashing.
- e. Sequence of construction, responsibilities, and schedule for subsequent operations.
- f. Installation procedures.
- g. Inspection procedures.
- h. Protection and repair procedures.
- i. Review and approval of all glazing applications.

1.5 DELIVERY, STORAGE, AND HANDLING:

- Q. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations. Remove damaged material from site and dispose of in accordance with applicable regulations.
- R. Protect air and water-resistive barrier components from freezing and extreme heat.
- S. Sequence deliveries to avoid delays, and to minimize on-site storage.

1.6 PROJECT CONDITIONS:

- T. Weather conditions: Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used.
 - 1. Apply at surface and ambient temperatures recommended by the manufacturer. See manufacturer's product data sheets for best practices.
 - 2. Proceed with installation only when the substrate construction and preparation work are complete and in condition to receive the membrane system.
 - 3. Exposure limitations: Schedule work to ensure that air and water-resistive barrier system is covered and protected from UV exposure within 180 days of installation. If air and water-resistive barrier membrane system cannot be covered within 180 days after installation, apply temporary UV protection as recommended by membrane manufacturer.

1.7 WARRANTY:

- U. Manufacturer's warranty requirements: Submit manufacturer's written warranty stating that installed air and water-resistive barrier materials are watertight, free from defects in material and workmanship, and agreeing to replace defective materials and components.
- V. Warranty period: Ten (10) years from Date of Substantial Completion.

PART 2 – PRODUCTS

2.1 MANUFACTURER:

- A. **PROSOCO, Inc.**
- B. **Sto Corp.**
- C. **DuPont Building Innovations.**
- D. **Carlisle Coatings & Waterproofing.**
- E. **Parex USA.**

2.2 WATER BASED PRIMER FOR RAW GYPSUM BOARD EDGES:

- A. Acceptable product: PROSOCO R-GUARD Primer or approved equal
- B. Description: Primer consolidates and seals the cut edges of gypsum wall boards where they are exposed in rough openings for windows and doors. The sealed edge makes a compatible surface for easy application of Joint & Seam Filler fiber-reinforced fill coat and seam treatment for through-wall components. Primer brushes or sprays on easily and is usually dry in 30 minutes.
- C. Characteristics:
 - 1. Form: milky blue liquid, mild odor
 - 2. Specific Gravity: 1.01
 - 3. pH: 8.5
 - 4. Weight per Gallon: 8.41 pounds
 - 5. Active Content: 18 percent
 - 6. Total Solids: 18 percent ASTM-D-2369
 - 7. Volatile Organic Content (VOC): less than 100 grams per Liter
 - 8. Flash point: greater than 212 degrees Fahrenheit (greater than 100 degrees Celsius) ASTM-D-3278
 - 9. Freeze Point: 32 degrees Fahrenheit (0 degrees Celsius)
 - 10. Shelf Life: 1 year in tightly sealed, unopened container

2.3 JOINT & SEAM FILLER FIBER REINFORCED FILL COAT AND SEAM FILLER:

- A. Acceptable product: PROSOCO R-GUARD Joint & Seam Filler or approved equal
- B. Description: Joint & Seam Filler is a high modulus, gun-grade, crack and joint filler, adhesive and detailing compound that combines the best silicone and polyurethane properties. This single-component, 99% solids, fiber-reinforced, Silyl-Terminated-Poly-Ether (STPE) is easy to gun, spread and tool.
- C. Characteristics:
 - 1. Thickness: Apply according to manufacturer's instructions. See product data sheet.
 - 2. Hardness: Shore A, 45-50 when tested in accordance with ASTM C661.
 - 3. Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E-96.
 - 4. Tensile strength: 225 psi when tested in accordance with ASTM D412.
 - 5. Lap shear strength: 275 psi when tested in accordance with ASTM D1002.
 - 6. Elongation at break: 275% when tested in accordance with ASTM D412.
 - 7. Peel strength: 30 pli when tested in accordance with ASTM D1781.
 - 8. Shrinkage: None.
 - 9. Form: pale red, gun-grade sealant
 - 10. Specific gravity: 1.40 to 1.50
 - 11. pH: not applicable
 - 12. Weight per gallon: 11.8 pounds
 - 13. Active content: 99 percent
 - 14. Total solids: 99 percent
 - 15. Volatile organic content (VOC): 30 grams per Liter, maximum
 - 16. Flash point: no data
 - 17. Freeze point: no date
 - 18. Shelf life: 1 year in tightly sealed, unopened container

2.4 LIQUID-APPLIED FLASHING MEMBRANE

- A. Acceptable product: PROSOCO R-GUARD Flashing or approved equal

- B. Description: Flashing is a gun-grade waterproofing, adhesive and detailing compound that combines the best of silicone and polyurethane properties. This single component, 99% solids, Silyl-Terminated-Poly-Ether (STPE) is easy to gun, spread and tool to produce a highly durable, seamless, elastomeric flashing membrane in rough openings of structural walls.
- C. Characteristics:
1. Thickness: Apply according to manufacturer's instructions.
 2. Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E96.
 3. Water penetration (cyclical static air pressure difference): No uncontrolled water penetration when tested in accordance with ASTM E547.
 4. Hardness: Shore A, 40-45 when tested in accordance with ASTM C661.
 5. Tensile strength: 180 psi when tested in accordance with ASTM D412.
 6. Elongation at break: 400% when tested in accordance with ASTM D412.
 7. Peel strength: 25 pli when tested in accordance with ASTM D1781.
 8. Form: Brick Red, Gun Grade Sealant.
 9. Specific gravity: 1.45 to 1.60
 10. pH: not applicable
 11. Weight per gallon: 12.5 pounds
 12. Active content: 99 percent
 13. Total solids: 99 percent
 14. Volatile organic content (VOC): 30 grams per Liter, maximum
 15. Flash point: no data
 16. Freeze point: no data
 17. Shelf life: 1 year in tightly sealed, unopened container

2.5 SPRAY WRAP AIR AND WATER-RESISTIVE BARRIER

- A. Acceptable product: PROSOCO R-GUARD Spray Wrap or approved equal

Note: All Air & Water Resistive Barriers must be installed by a waterproofing.

- B. Description: Spray Wrap is a fluid-applied air and water-resistive barrier that stops air and water leakage in cavity wall, masonry veneer construction, as well as in stucco, EIFS and most other building wall assemblies. Once on the substrate, the easily applied liquid quickly dries into a rubberized, highly durable, water-resistant, vapor-permeable membrane.
- C. Characteristics:
1. Thickness: Apply according to manufacturer's instructions. See product data sheet.
 2. Air infiltration: Less than 0.004 cfm per square foot (0.02 L/s/sq m) when tested in accordance with ASTM E2178 or ASTM E283.
 3. Air Barrier Assembly: pass when tested in accordance with ASTM E-2357.
 4. Water vapor permeability: 10.5 perms when tested in accordance with ASTM E96.
 5. Structural performance: Air and water-resistive barrier system shall withstand positive and negative wind pressure loading when tested in accordance with ASTM E330.
 6. Water penetration (static pressure): No uncontrolled water penetration when tested in accordance with ASTM E331.
 7. Flexibility: No cracking or de-lamination using 1/8 inch mandrel at 14 degrees Fahrenheit before and after aging when tested in accordance with ASTM D522.
 8. Tensile strength: Greater than 15 psi or exceeds strength of substrate when tested in accordance with ASTM C297.
 9. Nail Sealability: pass when tested in accordance with ASTM D1970.
 10. Surface burning: pass when tested in accordance with ASTM E84.
 11. Form: light red viscous liquid, mild odor
 12. Specific gravity: less than 1.0

13. pH: 7.5 to 10.0
14. Weight per gallon: 12.7 pounds
15. Active content: no data
16. Total solids: 62 percent by volume, ASTM-D-2369
17. Volatile organic content (VOC): less than 100 grams per Liter
18. Flash point: greater than 200 degrees Fahrenheit (greater than 93 degrees Celsius)
19. Freeze point: 32 degrees Fahrenheit (0 degrees Celsius)
20. Shelf life: 1 year in tightly sealed, unopened container

2.6 AIR AND WATERPROOF SEALANT FOR WINDOWS AND DOORS:

- A. Acceptable product: PROSOCO R-GUARD Weather Barrier or approved equal
- B. Description: Weather Barrier is a medium modulus sealant that combines the best silicone and polyurethane properties. This single component, 98% solids Silyl-Terminated-Poly-Ether (STPE) is easy to gun and tool in all weather conditions. Weather Barrier® cures quickly to produce a durable, high performance, high movement elastomeric interior air sealant
- C. Characteristics:
 1. Hardness: Shore A, 20-25 when tested in accordance with ASTM C661.
 2. Tensile strength: 110 psi when tested in accordance with ASTM D412.
 3. Elongation at break: 1300% when tested in accordance with ASTM D412.
 4. Peel strength: 30 pli when tested in accordance with ASTM D1781.
 5. Type: Type S, Grade NS, Class 50 when tested in accordance with ASTM C920.
 6. Shrinkage: None.
 7. Form: heavy white paste, mild odor
 8. Specific gravity: 1.3 to 1.4
 9. pH: not applicable
 10. Weight per gallon: 11.648 pounds
 11. Active content: 98 percent
 12. Total solids: 98 percent
 13. Volatile organic content (VOC): 30 grams per Liter, maximum
 14. Flash point: greater than 200 degrees Fahrenheit (greater than 93 degrees Celsius)
 15. Freeze point: not applicable
 16. Shelf life: 1 year in tightly sealed, unopened container
- D. Backer rod: Compressible, closed cell rod stock as recommended by manufacturer for compatibility with sealant. Provide size and shape of rod to control joint depth.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Verify that surfaces and conditions are ready to accept the Work of this section. Notify design professionals in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrates.
- B. All surfaces must be sound, clean and free of grease, dirt, excess mortar or other contaminants. Fill or bridge damaged surfaces, voids or gaps larger than one-half (1/2) inch with mortar, wood, metal, sheathing or other suitable material, as necessary. Fill voids and gaps measuring one-half (1/2) inch or less with Joint & Seam Filler as necessary to ensure continuity.

1. Surfaces to receive Spray Wrap, MVP, TMVP and VB may be dry or damp. Do not apply to surfaces which are sufficiently wet to transfer water to the skin when touched. Surfaces must be protected from rain for 2 hours following application.
 2. Surfaces to receive, Joint & Seam Filler, and Weather Barrier may be dry, damp or wet to the touch. Brush away any standing water which may be present before application. The products will tolerate rain immediately after application
- C. Where curing materials are used they must be clear resin based without oil, wax or pigments
- D. Condition materials to room temperature prior to application to facilitate extrusion and handling.

3.2 SURFACE PREPARATION:

- A. Air, water-resistive and waterproofing membrane and accessories may be applied to green concrete 16 hours after removal of forms.
- B. Refer to manufacturer's product data sheets for requirements for condition of and preparation of substrates.
1. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions.
 2. Remove contaminants such as grease, oil and wax from exposed surfaces.
 3. Remove dust, dirt, loose stone and debris.
 4. Use repair materials and methods that are acceptable to manufacturer of the air and water-resistive barrier system.
 5. The product line includes several options for preparing structural walls to receive the primary air and water resistive barrier. Refer to manufacturer's product data sheets and Installation Guidelines for additional information.
- C. Exterior sheathing:
1. Ensure that sheathing is properly installed with ends, corners and edges properly fastened.
 2. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing, fastened and spotted with Joint & Seam Filler and fastened into solid backing.
 3. Consolidate and seal the cut edges of gypsum wall boards exposed in rough openings for windows and doors at corners. The treated edge provides a suitable surface for application of Joint & Seam Filler fiber-reinforced coat and seam treatment.
- D. Masonry and concrete substrates:
1. Masonry head and bed joints should be fully filled and tooled.
 2. Mechanically remove loose mortar fins, mortar accumulations and protrusions, and debris.

3.3 INSTALLATION OF JOINT TREATMENT (PREPARE):

- A. Apply Joint & Seam Filler for seams, joints, cracks, gaps, primed rough gypsum edges at sheathing, rough openings:
1. Fill or repair cracks larger than one-half inch.
 2. Fill surface defects and over driven fasteners with Joint & Seam Filler.
 3. Using a dry knife, trowel or spatula, tool and spread the product. Spread one inch beyond seam at each side to manufacturer's recommended thickness. See product data sheet.
 4. Allow to skin before installing other waterproofing or air barrier components.
 5. Apply in accordance with manufacturer's Application Guideline illustrations.

3.4 FLASHING AT WINDOWS, DOORS, OPENINGS AND PENETRATIONS (PREPARE):

- A. Apply Flashing over surfaces prepared with Joint & Seam Filler to seal and waterproof rough openings:
 - 1. Apply a thick bead of Flashing over any visible gaps in the prepared rough opening.
 - 2. Immediately press and spread the wet product into gaps.
 - 3. Allow treated surface to skin.
 - 4. Starting at the top, apply a thick bead of Flashing in a zigzag pattern to the structural wall surrounding the rough opening.
 - 5. Spread the wet product to create an opaque, monolithic flashing membrane which surrounds the rough opening and extends 4 to 6 inches over the face of the structural wall. Apply and spread additional product as needed to create an opaque, monolithic flashing membrane free of voids and pin holes.
 - 6. Apply additional product in a zigzag pattern over a structural framing inside the rough opening.
 - 7. Apply Flashing within temperature and weather limitations as required by manufacturer.
 - 8. Apply Flashing to perimeters, sills and adjacent sheathing and building face, in accordance with manufacturer's product data sheet and Installation Guidelines illustrations.
 - 9. Extend flashing onto building face 4 to 6 inches.
 - 10. Install preparation products in accordance with manufacturer's Application Guideline illustrations.

3.5 AIR & WATER-RESISTIVE BARRIER INSTALLATION (PROTECT)

- A. Apply appropriate air and water-resistive barrier to a clean, dry substrate (clean, dry, and/or damp substrates use waterproofing air-barrier membrane), within temperature and weather limitations as required by manufacturer.
 - 1. Apply to recommended thickness. Proper thickness is achieved when coating is opaque.
 - 2. Allow product to cure and dry.
 - 3. Inspect membrane before covering. Repair any punctures, translucent or damaged areas by applying additional material.
 - 4. Specifier Note: If air or surface temperature exceed 95 degrees Fahrenheit (35 degrees Celsius), apply to shaded surfaces and before daytime air and surface temperatures reach their peak.
 - 5. On CMU wall construction back roll as necessary to ensure there are no pinholes, voids or gaps in the membrane.

3.6 FLASHING TRANSITIONS (TRANSITION)

- A. Apply Joint & Seam Filler and Flashing as a liquid flashing membrane to waterproof the transitions in rough opening and between dissimilar materials.
 - 1. Fill any voids between the top of the flashing leg and the vertical wall with R-GUARD Joint & Seam Filler. Tool to direct water from the vertical wall to the flashing.
 - 2. Apply a generous bead of Flashing to the top edge of the flashing leg.
 - 3. Spread the wet products to create a monolithic "cap-flash" flashing membrane extending 2 inches up the vertical face of the structural wall and 1 inch over the flashing membrane extending. Apply additional product as needed to achieve a void and pinhole free surface. This "liquid termination bar" helps secure the flashing and ensures positive drainage from the wall surface to the flashing.
 - 4. Allow treated surfaces to skin before installing other wall assembly, waterproofing or air barrier components.

3.7 AIR AND WEATHER BARRIER SEALANT FOR WINDOWS AND DOORS INSTALLATION

- A. Install Weather Barrier with professional grade caulking gun in continuous beads without air gaps or air pockets.

1. Apply Weather Barrier to a clean, dry or damp surface
2. Install Backer rod: Compressible, closed cell rod stock as recommended by manufacturer for compatibility with sealant. Provide size and shape of rod to control joint depth
3. Install Weather Barrier to provide uniform, continuous ribbons without gaps or air pockets, with complete wetting of the joint bond surfaces.
4. Tool sealant immediately to ensure complete wetting of joint bond surface and to produce a smooth, concave joint profile flush with the edges of the adjacent surfaces. Where horizontal and vertical surfaces meet, tool sealant to create a slight cove so as to not trap moisture or debris.
5. Do not allow materials to overflow onto adjacent surfaces. Prevent staining of adjacent surfaces.
6. Remove excess and misplaced materials as work progresses. Clean the adjoining surfaces to remove misplaced materials, without damage to adjacent surfaces or finishes.

END OF SECTION

SECTION 074213.53 - METAL SOFFIT, FASCIA and WALL Panels

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal soffit, Fascia & wall panels. (All Panels 22ga.)

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
- C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Ten years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of loads, as required by the International Building Code 2012 edition based on testing according to ASTM E 1592.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Based on calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL SOFFIT, FASCIA & WALL PANELS (All Panels 22ga.)

- A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners inside laps. Including accessories required for weathertight installation.
- B. Flush-Profile, Concealed-Fastener, Metal Soffit Panels: Solid panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Flush Panel – Smooth panel 12” x 1” Pac-Clad Petersen and Reveal panel – Smooth panel 12” x 1” with 1 1/2” reveal Pac-Clad Petersen or comparable product by one of the following:

Note: 1. 1 1/2” Reveal panel at all walls / Flush smooth NO REVEAL at fascia and soffits.
2. ALL METAL PANELS SHALL BE 22 GA.

- a. Architectural Building Components.
- b. AIM Metals, L.L.C.
- c. Fabral.
- d. Metal Sales Manufacturing Corporation.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 22 ga.
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range of colors including custom colors.
3. Panel Coverage: Nominal 12 inches.
4. Panel Height: 1.0 inch.
5. 1 ½" Revealed panels at all walls
6. Smooth panel NO REVEAL at fascia and soffits

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Sub-framing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Sealants: Provide sealant types recommended by manufacturers that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/8 inch thick.
 2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements

demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

- A. Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
 - 1. Soffit Framing: Clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.2 METAL PANEL INSTALLATION

- A. Metal Soffit Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
- B. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
- D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074213.53

SECTION 075419 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Work shall include, but is not limited to, the following:
 - 1. Fleece back PVC membrane adhered.
 - 2. PVC membrane flashings adhered.
 - 3. All related materials and labor required to complete specified roofing necessary to receive specified manufacturer's warranty.
- B. Steel Deck Flat and Sloped
ISO base layer mechanically attached
ISO/Tapered ISO additional layers and coverboard adhered
Fleece back 60 MIL PVC Adhered

1.02 RELATED SECTIONS

- A. Division 010000 – General Requirements
- B. Division 011000 – Summary of Work
- C. Division 072200 – Roof Insulation
- D. Division 076200 – Sheet Metal Flashing and Trim

1.03 DEFINITIONS

- A. ASTM D 1079 - Definitions of Term Relating to Roofing and Waterproofing.
- B. The National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual, Fifth Edition Glossary.

1.04 REFERENCES

- A. AMERICAN SOCIETY OF CIVIL ENGINEERS - Reference Document ASCE 7, Minimum Design Loads for Buildings and Other Structures.
- B. AMERICAN STANDARD OF TESTING METHODS (ASTM):
 - 1. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants
 - 2. ASTM D 751 - Standard Test Methods for Coated Fabrics.
 - 3. ASTM D 4434 - Standard for Polyvinyl Chloride Sheet Roofing.
 - 4. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.
 - 5. ASTM E 1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- C. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):
 - 1. ANSI/SPRI FX-1, Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.
 - 2. ANSI/FM 4474- American National Standard for Evaluating the Simulated Wind

Resistance of Roof Assemblies Using Static Positive and/or
Negative Differential Pressures.

- D. COOL ROOF RATING COUNCIL (CRRC)
- E. FACTORY MUTUAL (FM):
 - 1. FM 4450 - Approval Standard - Class I Insulated Steel Roof Decks.
 - 2. FM 4470 - Approval Standard - Class I Roof Covers.
- F. INTERNATIONAL CODES COUNCIL (ICC):
 - 1. 2021 International Building Code (IBC).
- G. NATIONAL ROOFING CONTRACTORS' ASSOCIATION (NRCA).
- H. SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION INC. (SMACNA) Architectural Sheet Metal Manual.
- I. SINGLE PLY ROOFING INDUSTRY (SPRI)
- J. UNDERWRITERS LABORATORY (UL):
 - 1. UL 790 Standard Test Methods for Fire Tests of Roof Coverings.

1.05 ACTION SUBMITTALS

- A. Product Data Sheets: Submit manufacturer's product data sheets, installation instructions and/or general requirements for each component.
- B. Quality Compliance (QC)/Certificate of Analysis (COA): Submit manufacturers QC or COA signed by company's Quality Department certifying membrane materials meet the specified properties listed in the specification.
- C. Material Safety Data Sheets: Submit manufacturer's Material Safety Data Sheets (MDS) for each component.
- D. 20 Year STATE OF LOUISIANA WARRANTY Sample/Specimen from the manufacturer and contractor.
- E. Manufacturer's application letter showing roofing contractors certification, application of the roof system from deck up, warranty approval, and fastening patterns.
- F. Shop Drawings: Provide roof plan and applicable roof system detail drawings.

1.06 INFORMATIONAL SUBMITTALS

- A. Contractor Certification: Submit written certification from roofing system manufacturer certifying that the applicator is authorized by the manufacturer to install the specified materials and system.

1.07 CLOSEOUT SUBMITTALS

- A. Warranty: Provide manufacturers and contractor's warranties upon substantial completion of the roofing system.

1.08 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:

- 1. Manufacturer shall have 20 years of experience manufacturing roofing materials.
- 2. Trained Technical Field Representatives, employed by the manufacturer, independent of sales.
- 3. Provide reports in a timely manner of all site visit reports.
- 4. Provide specified warranty upon satisfactory project completion.

B. CONTRACTOR QUALIFICATIONS:

- 1. Contractor shall be authorized by the manufacturer to install specified materials prior to the bidding period through satisfactory project completion.
- 2. Applicators shall have completed projects of similar scope using same materials as specified herein.
- 3. Contractor shall provide full time, on-site superintendent or foreman experienced with the specified roof system through satisfactory project completion.
- 4. Applicators shall be skilled in the application methods for all materials.
- 5. Contractor shall maintain a daily record, on-site, documenting material installation and related project conditions.
- 6. Contractor shall maintain a copy of all submittal documents, on-site, available always for reference.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Refer to each product data sheet or other published literature for specific requirements.
- B. Deliver materials and store them in their unopened, original packaging, bearing the manufacturer's name, related standards, and any other specification or reference accepted as standard.
- C. Protect and store materials in a dry, well-vented, and weatherproof location. Only materials to be used the same day shall be removed from this location. During cold weather, store materials in a heated location, removed only as needed for immediate use.
- D. When materials are to be stored outdoors, store away from standing water, stacked on raised pallets or dunnage, at least 4 in or more above ground level. Carefully cover storage with "breathable" tarpaulins to protect materials from precipitation and to prevent exposure to condensation.
- E. Properly dispose of all product wrappers, pallets, cardboard tubes, scrap, waste, and debris. All damaged materials shall be removed from job site and replaced with new, suitable materials.

1.10 SITE CONDITIONS

A. SAFETY:

- 1. The contractor shall be responsible for complying with all project-related safety

- and environmental requirements.
2. Hot-air welding shall include heating the specified membrane ply using electric hot-air welding equipment. The contractor shall determine when and where conditions are appropriate to utilize hot-air welding equipment. When conditions are determined by the contractor to be unsafe to proceed, materials and methods shall be utilized to accommodate requirements and conditions.
 3. The contractor shall refer to product Safety Data Sheets (SDS) for health, safety, and environment related hazards, and take all necessary measures and precautions to comply with exposure requirements.

B. ENVIRONMENTAL CONDITIONS:

1. Monitor substrate temperature and material temperature, as well as all environmental conditions such as ambient temperature, moisture, sun, cloud cover, wind, humidity, and shade. Ensure conditions are satisfactory to begin work and ensure conditions remain satisfactory during the installation of specified materials. Materials and methods shall be adjusted as necessary to accommodate varying project conditions. Materials shall not be installed when conditions are unacceptable to achieve the specified results.
2. Precipitation and dew point: Monitor weather to ensure the project environment is dry before, and will remain dry, during the application of roofing materials. Ensure all roofing materials and substrates remain above the dew point temperature as required to prevent condensation and maintain dry conditions.
3. Hot-air Welding Application: Take all necessary precautions and measures to monitor conditions to ensure all environmental conditions are safe to proceed with the use hot-air welding equipment. Combustibles, flammable liquids, and solvent vapors that represent a hazard shall be eliminated and primers shall be fully dry before proceeding with hot air welding operations.

1.11 PERFORMANCE REQUIREMENTS

A. WIND UPLIFT RESISTANCE:

1. Performance testing shall be in accordance with ANSI/FM 4474, FM 4450, FM 4470, UL 580 or UL 1897.
 - a. Roof System Design Pressures: Calculated in accordance with ASCE 7-16, or applicable standard, for the specified roof system attachment requirements: (See Structural drawings)
 - i Field of Roof (Zone 1'): [- 00.0 psf.]
 - ii Field of Roof (Zone 1): [- 00.0 psf.]
 - iii Perimeter of Roof (Zone 2): [- 00.0 psf.]
 - iv Corners of Roof (Zone 3): [- 00.0 psf.]
 - v MINIMUM 1-90 requirements

B. FIRE CLASSIFICATION:

1. Performance testing shall be in accordance with UL 790, ASTM E108, FM 4450 or FM 4470 to meet the 1/4:12 roof slope requirement.
 - a. Meets requirements of UL Class A or FM Class A.
2. Performance testing shall be in accordance with UL 1256, FM 4450, or FM 4470

to meet the specified requirements for interior flame spread and fuel contribution.

- a. Meets requirements of UL 1256, or FM Class 1.

C. ROOF SLOPE:

1. Finished roof slope for PVC surfaces shall be ¼ inch per foot (2 percent) minimum for roof drainage.

D. IMPACT RESISTANCE:

1. Performance testing for impact resistance shall be in accordance with FM 4450, FM 4470, or ASTM D4272 to meet the specified impact resistance requirements.
 - a. Meets requirements for FM-SH (Severe Hail).

E. COOL ROOF RATING COUNCIL (CRRC):

1. Fleece-backed, bright white PVC membrane shall be listed by the Cool Roof Rating Council (CRRC) with the following minimum published values:
 - a. Solar Reflectance: Initial: 0.87 3 Year: 0.67
 - b. Thermal Emittance: Initial: 0.89 3 Year: 0.89
 - c. Solar Reflectance Index (SRI): Initial: 110 3 Year: 81

1.12 WARRANTY

- A. STATE OF LOUISIANA'S 20 Year No Dollar Limit (NDL) Warranty shall be acceptable to Facility Planning and Control. The manufacturer shall provide the owner with the manufacturer's warranty providing labor and materials to for 20 years from the date the warranty is issued.
- B. The contractor shall guarantee the workmanship and shall provide the owner with the contractor's warranty covering workmanship for a period of 2 years from completion date.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. SINGLE SOURCE MANUFACTURER: All PVC membrane, flashing and accessories shall be manufactured by a single supplier with 20 years or more manufacturing history in the US.
 1. Comply with the Manufacturer's requirements as necessary to provide the specified warranty.
- B. PRODUCT QUALITY ASSURANCE PROGRAM: Manufacturer shall be an ISO 9001 registered company.
- C. ACCEPTABLE MANUFACTURER:
 1. Soprema
 2. Siplast
 3. John Manville

2.02 ROOFING SYSTEM

2.03 PVC MEMBRANES 60 MIL MINIMUM FLEECE BACK

A. ADHERED MEMBRANE:

1. PVC MEMBRANE, ADHERED:

- a. Polyester reinforced, thermoplastic polyvinyl chloride (PVC) membrane with a heavy fleece back underside.
 - i Membrane Thickness (above fleece) ASTM D4434: 60 mils minimum
 - a) Manufacturer shall provide membrane at specified minimum of 60 mils
 - b) ASTM D4434 +/- tolerance for membrane thickness will not be accepted.
 - ii Thickness over Scrim (ASTM D7635): 30 mils minimum
 - a) Manufacturer shall provide membrane with minimum 30 mils compound thickness above reinforcement
 - iii Width: 10 ft (3.0 m)
 - iv Length: 80 ft (24.4 m)
 - v Physical Properties ASTM D4434.
 - a) Breaking Strength, lbf/in: 500 (MD) 400 (XMD)
 - b) Elongation at Break %: 30 (MD) 30(XMD)
 - c) Tear Strength, lbf: 150 (MD) 100 (XMD)
 - d) Linear Dimensional Change - %: <0.1%
 - vi Color: White

2. PVC FLASHING, 60 MIL MINIMUM BARE BACK ADHERED:

2.04 ACCESSORIES

A. MEMBRANE ADHESIVES:

- 1. BONDING ADHESIVE: Solvent-based adhesive. Formulated to adhere smooth back PVC membranes.
 - a. VOC Content: 199.5 g/L or less.
- 2. SPATTER PATTERN ADHESIVE: Two-component elastomeric polyurethane adhesive. Formulated to adhere fleece back PVC membranes.
 - a. VOC Content: 98 g/L or less.

B. FLASHING ADHESIVES:

- 1. BONDING ADHESIVE: Solvent-based adhesive. Formulated to adhere smooth back PVC flashings.
 - a. VOC Content: 199.5 g/L or less.

C. SEALANTS:

- 1. Gun grade, moisture curing, polyether, elastomeric sealant for SENTINEL® PVC membrane terminations.
 - a. VOC Content: 20 g/L or less
 - b. Meets or exceeds ASTM C920, Type S, Grade NS, Class 25
 - c. Color: White

2. BUTYL SEALANT TAPE: Butyl rubber and polyisobutylene water resistant sealant tape for concealed sheet metal joints and water cutoff.
3. BUTYL SEALANT: Butyl rubber and polyisobutylene water resistant sealant for concealed sheet metal joints and water cutoff.

D. MEMBRANE ACCESSORIES:

1. DETAILING MEMBRANE: Fiberglass reinforced, thermoplastic polyvinyl chloride (PVC) membrane with a smooth back underside.
 - a. Overall Thickness ASTM D4434 (ASTM D638): 60 mils minimum
 - i Colors: White
 - ii Size: 2.5 ft x 100 ft (0.76 m x 30 m)
2. MOLDED OUTSIDE CORNER: Injection Molded Corner
 - a. Color: White
3. MOLDED INSIDE CORNER: Injection Molded Corner
 - a. Color: White
4. T-JOINT PATCHES: 4.5 in Round T-Joint Patch
 - a. Color: White
5. PVC PIPE FLASHING: Prefabricated PVC pipe flashing.
 - a. Size: Size as required.
 - b. Color: White
6. PVC CLOSED PIPE BOOT: Prefabricated PVC pipe flashing.
 - a. Size: 1"-6"
 - b. Color: White
7. WALKWAY PAD: PVC walkway protection mat.
 - a. Width: 30 in (0.762 m)
 - b. Length: 50 ft (15.24 m)
 - c. Color: Grey

E. SHEET METAL FLASHING:

1. Contractor shall furnish all sheet metal flashings, counter flashings, roof edge system, and all other related sheet metal flashings and associated fasteners necessary to flash and counter flash the specified roofing system.
2. Sheet metal flashing materials and fasteners shall be compatible with adjacent materials, to accommodate all project related exposures.
3. Vinyl Coated Metal: 24-gauge galvanized sheet steel with a 20 mil, UV-resistant PVC coated topside.
 - a. Vinyl Coated metal: PVC coated metal.
 - i Width: 4 ft (1.219 m)
 - ii Length: 10 ft (3.048 m)
 - iii Color: [White][Grey][Tan]. Selected by Owner / Architect.
4. Pre-Finished (Mill Finished) Sheet Metal Flashing Material: [Aluminum][Galvanized Steel][Stainless Steel].
5. Roof Edge System: Tested per ANSI/SPRI ES-1 to meet or exceed design pressures at roof edge.

F. LIQUID-APPLIED REINFORCED FLASHING SYSTEM:

1. Catalyzed polymethyl methacrylate (PMMA) resin with polyester reinforcing fleece fabric fully embedded into the resin to form fully reinforced waterproofing membrane flashings.
 - a. VOC Content: No VOC content.
 - b. Polymethyl methacrylate (PMMA) liquid resin.
 - c. Reactive agent added to the PMMA liquid resin to induce curing.
 - d. Polyester reinforcement fabric.
 - e. Color: Flash color and finish to match Field.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examination includes visual observations, qualitative analysis, and quantitative testing measures as necessary to ensure conditions remain satisfactory throughout the project.
- B. The contractor shall examine all roofing substrates including, but not limited to: insulation materials, roof decks, walls, curbs, rooftop equipment, fixtures, and wood blocking.
- C. The applicator shall not begin installation until conditions have been properly examined and determined to be clean, dry and, otherwise satisfactory to receive specified roofing materials.
- D. During the application of specified materials, the applicator shall continue to examine all project conditions to ensure conditions remain satisfactory to complete the specified roofing system.

3.02 PREPARATION

- A. Before commencing work each day, the contractor shall prepare all roofing substrates to ensure conditions are satisfactory to proceed with the installation of specified roofing materials. Preparation of substrates includes, but is not limited to, substrate repairs, securement of substrates, eliminating all incompatible materials, and cleaning.
- B. Where conditions are found to be unsatisfactory, work shall not begin until conditions are made satisfactory to begin work. Commencing of work shall indicate contractor's acceptance of conditions.

3.03 HOT-AIR WELDING

- A. The Contractor is responsible for project safety. Hot air shall be used to seal membrane side and end laps. Refer to NRCA CERTA, local codes and building owner's requirements for hot work operations.
- B. Position the membrane so that it overlaps the adjacent membrane at the required side lap width. Ensure the laps are dry, clean, and free of foreign material.
- C. Weld the laps together with an automatic welding machine or hand welder maintaining a minimum 1.5 in continuous weld. All seams shall be inspected for a continuous weld.
- D. At end-laps of bare back membranes, round the corners by cutting a radius on both corners.
- E. Fleece back membrane end laps shall be butted to one another and a 6 in membrane cover strip welded on top.

- F. T-JOINT PATCHES shall be hot-air welded to the membrane at all t-joint intersections. Chamfer the welding seam prior to installing T-Joint patches using an edging tool or by heating the edge and rolling.
- G. PVC CUT EDGE SEALANT shall be installed at all non-factory cut edges.

3.04 FLEECE BACK ADHERED MEMBRANE APPLICATION BONDING ADHESIVE

- A. The ambient temperature shall be above 50°F (10°C).
- B. BONDING ADHESIVE may be applied using a 3/8 in nap solvent resistant roller.
- C. Apply adhesive to clean, dry, and prepared compatible substrates as required to ensure full adhesion at the application rate published on the product data sheet.
- D. Apply adhesive to the underside of the bare back membrane at the application rate published on the product data sheet.
- E. Allow the adhesive on both surfaces to dry to a tacky feel when touched with a dry finger.
- F. Mate the membrane to the substrate avoiding any air entrapment or wrinkles and apply pressure with a roller or push broom to ensure complete bonding.
- G. At the end of the sheet where it terminates at roof edges, walls, and curbs, fasten the perimeter of the membrane with appropriate fasteners and seam plates to the deck or vertical surface at the base of the upstand.
- H. Hot air weld all side and end laps.
- I. At PVC terminations at roof edges, walls, and curbs, fasten the perimeter edge of the membrane with appropriate fasteners, seam plates or flat termination bars to the horizontal deck or vertical substrate along the termination.
- J. Fasten membrane termination 12 in on-centers maximum along membrane terminations. Locate the edge of the fastener plate 1 in or more back from the edge of the membrane.
- K. Probe all seams/laps once the hot air welds have thoroughly cooled.
- L. Repair all seam deficiencies the same day they are discovered.

3.05 FLEECE BACK ADHERED MEMBRANE APPLICATION SPATTER PATTERN

- A. Follow material product data sheets and published general requirements for installation instructions.
- B. Apply adhesive from spray nozzle located 2 to 3 feet above the roof surface using a sweeping motion from side to side to evenly distribute the adhesive at approximately 3,000 square feet (30 squares) per adhesive kit.
- C. Apply adhesive to prevent contact between bare PVC side-laps and the adhesive.
- D. Monitor changing environmental conditions to ensure satisfactory results as adhesive set time varies with environmental conditions.
- E. Unroll the PVC membrane into the adhesive so only the fleece contacts adhesive. Prevent contact between bare side laps and adhesive.
- F. Unroll the PVC to prevent wrinkles and apply pressure using a roller or push broom to ensure complete adhesion between the fleece underside and the adhesive.
- G. End-laps shall be butted, and a 6 in wide PVC membrane cover-strip shall be welded over the butted end joint.
- H. T-JOINT PATCHES shall be hot-air welded to the membrane at all T-joint intersections. Chamfer the welding seam prior to installing T-Joint patches using an edging tool or by heating the edge and rolling.
- I. Hot-air weld all side and end-laps with minimum 1-1/2 in welds.
- J. Fasten PVC terminations located at roof edges, walls, and curbs, using appropriate fasteners, seam plates or flat termination bars. Install fasteners into the horizontal deck or vertical substrate along the termination.

- K. Fasten membrane termination 12 in on-centers maximum along membrane terminations. Locate the edge of the fastener plate 1 in or more back from the edge of the membrane.
- L. Probe all seams/laps once the hot air welds have thoroughly cooled.
- M. Repair all seam deficiencies the same day they are discovered.

3.06 PVC FLASHING BARE BACK MEMBRANE APPLICATION

- A. Follow material product data sheets and published general requirements for installation instructions.
- B. Ensure field membrane is fastened and secure to the substrate at all membrane terminations before PVC flashing is installed.
- C. Ensure PVC membrane and substrates are dry, clean, and free of asphalt and all bitumen-based products. Do not allow bare PVC to meet asphalt or bitumen-based products.
- D. Where required, cover walls and other flashing substrates using specified wood, gypsum or cement roof boards securely fastened in place.
- E. The ambient temperature shall be above 40°F (4.4°C) during adhesive application. Ensure temperature is well above the dew point temperature to prevent condensation during adhesive application.
- F. Apply BONDING ADHESIVE using 3/8 in nap solvent resistant rollers to clean, dry and prepared flashing substrates, and onto the underside of the bare PVC membrane. Refer to product data sheet for application rate.
- G. Prevent adhesive from contacting the membrane at the side and end-laps that are to be hot-air welded.
- H. Allow the adhesive on both surfaces to dry to the touch. Adhesive may be tacky to-the-touch, but not wet. Adhesive should not transfer to the fingertips when touched.
- I. Mate the PVC flashing membrane to the flashing substrate. Prevent air entrapment and wrinkles. Apply pressure with hands, roller, or broom to ensure complete adhesion.
- J. Hot air weld all laps with minimum 1-1/2 in welds.
- K. Probe all seams/laps once the hot air welds have thoroughly cooled.
- L. Repair all seam deficiencies the same day they are discovered
- M. Fasten top leading edge of vertical PVC flashings. Refer to detail drawings.

3.07 LIQUID-APPLIED, PMMA MEMBRANE AND FLASHING SYSTEM APPLICATION

- A. Refer to manufacturer's details drawings, product data sheets and published general requirements for application rates and specific installation instructions.
- B. PVC membrane preparation:
 - 1. Ensure the PVC field membrane is fastened and secure to the substrate at all membrane terminations before liquid-applied flashing is installed.
 - 2. Install a welded PVC cover-strip over fasteners where applicable. Ensure cover-strip is welded tight, with no loose ends or open laps.
 - 3. Ensure PVC membrane and substrates are dry, clean, and free of asphalt and all bitumen-based products. Do not allow bare PVC to meet asphalt or bitumen-based products.
 - 4. Lightly abrade the PVC membrane surface where liquid-applied membrane is to be applied.
 - 5. Wipe PVC membrane surface clean using CLEANER and allow too fully dry.
- C. Pre-cut polyester reinforcing fleece to conform to roof terminations, transitions and penetrations being flashed. Ensure a minimum 2 in overlap of fleece at side and end-laps. Ensure the completed liquid-applied flashing membrane is fully reinforced.

- D. Apply the base coat of catalyzed resin onto the substrate using a brush or roller, working the material into the surface for complete coverage and full adhesion.
- E. Immediately apply the reinforcing into the wet base coat of resin. Using a brush or roller, work the reinforcing fabric into the wet resin while applying the second coat of catalyzed resin to completely encapsulate the fleece.
- F. Refer to reinforced, polymethyl-methacrylate (PMMA) specification section and application instructions, details drawings, product data sheets and published general requirements for complete installation instructions.

3.08 SHEET METAL FLASHING APPLICATION

- A. Refer to sheet metal flashing detail drawings and follow product data sheets and published general requirements for installation instructions.
- B. Follow the most recent edition of the SMACNA Architectural Sheet Metal Manual for fabrication and installation requirements.

3.09 WALKWAYS

- A. At areas outlined on the drawings, and around the perimeter of all rooftop equipment and at all door and stair landings, install walkway protection.
- B. Cut walkway from end of WALKWAY PAD.
- C. Hot air weld the entire perimeter of the WALKWAY PAD to the membrane.

3.10 CLEAN-UP

- A. Clean-up and properly dispose of waste and debris resulting from these operations each day as required to prevent damages and disruptions to operations.

END OF SECTION

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Loosely laid and ballasted thermoplastic polyolefin (TPO) roofing system.
3. Roof insulation.

- B. The existing roof system is under warranty and must be modified in a manner that maintains the existing warranty. The roof is a Johns Manville SBS modified bitumen system. Exact membrane and insulation types are as originally installed and must be field verified. All roofing work shall be performed by a contractor certified by Johns Manville, and written confirmation must be provided that all modifications will not void the existing warranty.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For the following products:
1. Sheet roofing, of color required.
 2. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

- A. Research/Evaluation Reports: For components of roofing system, from ICC-ES.
- B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer No Dollar Limit (NDL), non-prorated warranty agreeing to repair roofing system, replace components of roofing system or the total replacement of the roofing system(s) that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: 20 years from date of Substantial Completion.

- B. The existing roof system is under warranty and must be modified in a manner that maintains the existing warranty. The roof is a Johns Manville SBS modified bitumen system. Exact membrane and insulation types are as originally installed and must be field verified. All roofing work shall be performed by a contractor certified by Johns Manville, and written confirmation must be provided that all modifications will not void the existing warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Johns Manville as listed or comparable product by one of the following:

- 1. Carlisle SynTec Incorporated.
 - 2. GAF Materials Corporation.
 - 3. Johns Manville.
 - 4. Soprema

- B. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
- B. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

- C. Roofing System Design: Tested by a qualified testing agency to resist the uplift pressures as required by the International Building Code, 2015 edition and to achieve a FM Global 1-90 rating.
- D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

- A. Fleece-backed Fabric-Reinforced TPO Sheet: Firestone Building Products; Ultraply TPO XR 115.
 - 1. Thickness: 60 mils, nominal.
 - 2. Exposed Face Color: White.

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.
- C. Bonding Adhesive: Firestone Building Products; XR Bonding Adhesive.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.
- E. Miscellaneous Accessories: Provide metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: Firestone Building Products; ISO 95+, ASTM C 1289, Type II, Class 1, felt or glass-fiber mat facer on both major surfaces.
- B. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.7 ASPHALT MATERIALS

- A. Roofing Asphalt: [ASTM D 312, Type III or Type IV] [ASTM D 6152, SEBS modified].
- B. Asphalt Primer: ASTM D 41/D 41M.

2.8 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- 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. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.2 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

- B. Install tapered insulation under area of roofing to conform to slopes indicated.
- C. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- D. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

3.3 ADHERED ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
- B. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- D. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- E. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.4 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.5 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.6 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SEE ATTACHED EXISTING ROOF WARRANTY FOR REFERENCE ONLY.

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counter-flashing.
2. Formed wall sheet metal fabrications.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product certificates.

- B. Product test reports.

- C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge and eave, including fascia and fascia trim, approximately 2 feet long.

1.7 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. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As required by the International Building Code.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color: As selected by Architect from manufacturer's full range.
- C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

- A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Atlas Roofing Corporation; Summit.
 - b. Engineered Coated Products; Nova-Seal II.
 - c. Kirsch Building Products, LLC; Sharkskin Comp.
 - d. SDP Advanced Polymer Products Inc; Palisade.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal[or manufactured item] unless otherwise indicated.
- B. Fasteners: 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 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 Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 4. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.5 MANUFACTURED REGLETS

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corporation.
 - b. Heckmann Building Products, Inc.
 - c. Hickman, W. P. Company.
 - d. Hohmann & Barnard, Inc.
 2. Material: Stainless steel, 0.019 inch thick, Aluminum, 0.024 inch thick or Galvanized steel, 0.022 inch thick.
 3. Finish: With manufacturer's standard color coating. Colors selected by Architect.

2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Obtain field measurements for accurate fit before shop fabrication.
 2. 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.
 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. 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.
- C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

- F. Seams: 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.
- G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 - 1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

- 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. 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. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel and aluminum sheet.
 - 2. Do not use torches for soldering.
 - 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 - 5. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
- H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.2 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.3 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of

wall flashing with installation of wall-opening components such as windows, doors, and louvers.

- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb and similar flashings to extend 4 inches beyond wall openings.

3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge flashings.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.

1.2 PERFORMANCE REQUIREMENTS

- A. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
1. Design Pressure: As required by the International Building Code 2012 edition.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
1. Basis of Design: Subject to compliance with requirements, provide products by one of the following:
 - a. Pac-Clad 800.441.8661
 - b. Hickman 828.274.4000
 2. Surface: Smooth, flat finish.
 3. Exposed Coil-Coated Finishes: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 1) Color: As selected by Architect from manufacturer's full range.

2.2 CONCEALED METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
- C. Polyethylene Sheet: 6-mil thick polyethylene sheet complying with ASTM D 4397.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- D. Butyl Sealant: ASTM C 1311, 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 complying with ASTM D 1187.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 COPINGS

- A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps. **Subject to compliance with requirements, provide products by one of the following.**
 - a. Pac-Clad 800.441.8661 2. Hickman 828.274.400
- 1. Coping-Cap Material: Zinc-coated steel, nominal thickness as required to meet performance requirements but not less than 22 gauge.
 - a. Finish: Two-coat fluoropolymer.
 - b. Color: Selected by Architect from manufactures full range.
- 2. Corners: Factory mitered and mechanically clinched and sealed watertight.
- 3. Coping-Cap Attachment Method: Face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
- 4. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
- 5. Face Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.6 ROOF-EDGE FLASHINGS

- A. Roof-Edge Fascia and: Manufactured, two-piece, roof-edge fascia consisting of compression-clamped metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
1. **Manufacturers: Subject to compliance with requirements, provide products by one of the following:**
 - a. Pac-Clad. 800.441.8661
 - b. Hickman 828.274.400
 2. Fascia Cover: Fabricated from the following exposed metal:
 - a. Zinc-Coated Steel: Nominal thickness as required to meet performance requirements but not less than 22 gauge.
 3. Corners: Factory mitered and mechanically clinched and sealed watertight.
 4. Splice Plates: Exposed, of same material, finish, and shape as fascia cover.
 5. Special Fabrications: Radiussed sections, Arched sections, Bullnose fascia cover, Cornice fascia cover and Cove fascia cover, as indicated by drawings.
 6. Fascia Accessories: Fascia extenders with continuous hold-down cleats and Wall cap.

2.7 ROOF-EDGE DRAINAGE SYSTEMS

1. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters. **Manufacturers: Subject to compliance with requirements, provide products by one of the following:**
 - a. Pac-Clad. 800.441.8661
 - b. Hickman 828.274.400
 2. Fabricate from the following exposed metal:
 - a. Zinc-Coated Steel: Nominal 0.028-inch thickness.
 3. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
 4. Corners: Factory mitered and mechanically clinched and sealed watertight.
 5. Gutter Supports: Straps.
 6. Gutter Accessories: Continuous hinged leaf guard of solid metal designed to shed leaves.
- B. Downspouts: Plain rectangular complete with machine-crimped elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Zinc-Coated Steel: Nominal 0.034-inch thickness.

C. Zinc-Coated Steel Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.
1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Install underlayment with adhesive for temporary anchorage. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches. Roll laps of self-adhering sheet underlayment with roller; cover within 14 days.
- 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. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of 12 feet with no joints within 18 inches corners or intersections unless otherwise shown on Drawings.
 2. When ambient temperature at time of installation is between 40 and 70 deg F set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 3/4 inch for wood screws (nails are not acceptable) and substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints with sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.2 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings to meet performance requirements.
 - 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.
 - 2. Interlock face leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.3 ROOF-EDGE FLASHING INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.4 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 30 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.
 - 2. Install continuous leaf guards on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.

- C. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Equipment supports.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory indicated.
- B. Shop Drawings: For roof accessories.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items.
- B. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 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 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

1. Exposed Coil-Coated Finish: Two-coat fluoropolymer finish; AAMA 621; system consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
- B. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. 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.
- C. Sealants: As recommended by roof accessory manufacturer for installation indicated.

2.3 ROOF CURBS

- A. Roof Curbs, General: Provide roof curbs, as specified by this Section, unless otherwise specified by Division 23 "HVAC."
- B. Roof Curbs: Internally reinforced roof-curb units with integral spring-type vibration isolators and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation and integrally formed deck-mounting flange at perimeter bottom.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AES Industries, Inc.
 - b. Curbs Plus, Inc.
 - c. Custom Solution Roof and Metal Products.
 - d. Greenheck Fan Corporation.
 - e. LM Curbs.
 - f. Metallic Products Corp.
 - g. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - h. Pate Company (The).
 - i. Roof Products, Inc.
 - j. Safe Air of Illinois.
 - k. Thybar Corporation.
 - l. Vent Products Co., Inc.
- C. Material: Zinc-coated (galvanized) steel sheet, 0.080 inch thick, but not less than required to support superimposed live and dead load, including equipment loads.
 1. Finish: Two-coat fluoropolymer.

2. Color: As selected by Architect from manufacturer's full range.

D. Construction:

1. Insulation: Factory insulated with 1-1/2-inch glass-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 8 inches, above finished roof, unless otherwise indicated to be fabricated taller.
6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Verify dimensions of roof openings for roof accessories. 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, excessive oil canning, buckling, or tool marks.
 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 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. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
- C. Seal joints with sealant as required by roof accessory manufacturer.

3.2 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

- B. 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

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

B. Product test reports.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by UL, FM Global or other qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hilti, Inc.
 2. Johns Manville.
 3. RectorSeal Corporation.
 4. Specified Technologies Inc.
 5. 3M Fire Protection Products.
 6. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: 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: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: 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 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- 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 manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- 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. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- D. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.3 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Preformed joint sealants.

1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers eight samples of materials that will contact or affect joint sealants. Use ASTM C 1087 or manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each kind and color of joint sealant required.
- C. Joint-Sealant Schedule: Include the following information:
 1. Joint-sealant application, joint location, and designation.
 2. Joint-sealant manufacturer and product name.
 3. Joint-sealant formulation.
 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Preconstruction compatibility and adhesion test reports.
- C. Preconstruction field-adhesion test reports.

- D. Field-adhesion test reports.
- E. Warranties.

1.5 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

2.2 SILICONE JOINT SEALANTS

- A. Mildew-Resistant, Neutral-Curing Silicone Joint Sealant: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Dow Corning Corporation.
 - c. GE Advanced Materials - Silicones.
 - d. May National Associates, Inc.
 - e. Pecora Corporation.
 - f. Polymeric Systems, Inc.
 - g. Schnee-Morehead, Inc.
 - h. Sika Corporation; Construction Products Division.
 - i. Tremco Incorporated.
2. Type: Single component (S).
3. Grade: Nonsag (NS).
4. Class: 2.
5. Uses Related to Exposure: Traffic (T) or Nontraffic (NT), as applicable to exposure.

2.3 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Lyntal, International, Inc.
 - d. May National Associates, Inc.
 - e. Pacific Polymers International, Inc.
 - f. Pecora Corporation.
 - g. Polymeric Systems, Inc.
 - h. Schnee-Morehead, Inc.
 - i. Sika Corporation; Construction Products Division.
 - j. Tremco Incorporated.
2. Type: Multicomponent (M).
3. Grade: Nonsag (NS).
4. Class: 25.
5. Uses Related to Exposure: Traffic (T) or Nontraffic (NT), as applicable to exposure.

2.4 PREFORMED JOINT SEALANTS

- A. Preformed Foam Joint Sealant : Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes

in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dayton Superior Specialty Chemicals.
 - b. EMSEAL Joint Systems, Ltd.
 - c. Sandell Manufacturing Co.
 - d. Schul International, Inc.
 - e. Willseal USA, LLC.

2.5 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
 1. Remove laitance and form-release agents from concrete.
 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 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.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- F. 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.

3.3 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

END OF SECTION 079200

SECTION 079500 - EXPANSION JOINTS**PART 1 – GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes:
- B. Scope of Work
 - 1. Interior expansion control systems
 - 2. Exterior expansion control systems
 - 3. Expansion Joint accessories including provisions for fire rated assemblies, moisture barriers, waterproofing, acoustic and thermal measures.
- C. Provide all labor, materials and services to perform operations in connection with furnishing, delivery, and installation of work related to this section.

1.03 RELATED WORK

- A. Related work includes but is not limited to:
 - 1. Cast-In-Place Concrete: Section 03300.
 - 2. Unit Masonry: Section 04810.
 - 3. Structural Steel: Section 05120.
 - 4. Light Gage Metal Framing: Section 05400.
 - 5. Roofing and Waterproofing: Section 07500
 - 6. Roof Expansion Assemblies - 07716
 - 7. Sheet Metal Flashing and Trim: Section 07620.
 - 8. Joint Sealants as Weather Seals: Section 07900
 - 9. Cement Plaster: Section 09210.
 - 10. Gypsum Wallboard: Section 09260.

1.04 REFERENCES

- A. Work shall be performed following applicable Local, State, and Federal codes and regulations.
- B. Publications listed herein are part of this specification. See below for standards where applicable to the product listed:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM B221, "Standard Specifications for Aluminum and Aluminum-Alloy Extrusions."
 - b. ASTM B209, "Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - c. ASTM E1399 "Cyclic Movement and Measuring of Minimum/Maximum Joint Widths of Architectural Joint Systems."
 - d. ANSI/U.L. No. 263, UL2079, ULCS115, EN1366-4 Fire Rated Testing for full rated period. Underwriter's Laboratories shall classify adjacent substrate assemblies.
 - e. ASTM E1612, Standard Specification for Preformed Architectural Compression Seals for Buildings and Parking Structures.

2. American National Standards Institute (ANSI):
 - a. ANSI A137.1/A326.3 (2018), "Method for Measuring Dynamic Coefficient of Friction on Hard Flooring Materials"

1.05 DEFINITIONS

A. Product Movement capabilities

1. Product operating range defined as a percentage of the nominal joint width.
2. Industry standard requirements: 25%+- operating range for thermal conditions. 50%+- operating range for seismic and windsway conditions.
3. 100%+- operating range for seismic and windsway conditions with lateral shear capable systems that allow for movement parallel to joint orientation.

B. Product "Load" descriptions:

1. Standard Loads: common applications with high volume pedestrian crossing. Applicable for typical office settings or other spaces where occasional rubber wheeled traffic (i.e.- mail carts, trolleys, light weight cleaning equipment and luggage) will be encountered. 500 lb. [230 kg] maximum.
2. Moderate Loads: suggests applications where occasional heavier maintenance equipment with soft rubber tires (such as gurneys, light duty scissor lifts, motorized cleaning equipment) would be added to the Standard traffic definition. The systems in this category are comprised of heavier aluminum extrusions and thicker walled extruded rubber seals. 1000 lb [450 kg] maximum.
3. Heavy Duty Concentrated Loads: reserved for project conditions where heavy loads (i.e.- vehicles, mobile medical equipment, coin carts, materials handling equipment) are common. Capable of multi-directional movement and resistance to recurring lateral impact forces. Typical 2000 lb. [910 kg] maximum. *7000 lb. [3175 kg] (*Specific models only).

1.06 SYSTEM DESCRIPTION

A. Joint coverplate systems shall permit daily thermal expansion and contraction of building elements, minor foundation settlement, and common windsway movements of the structure without disengagement.

1. Joint system details shall clearly indicate X-axis joint movement capabilities (horizontal contraction/ expansion). Y-axis joint movement (in-plane shear), and Z-axis movement (vertical shear) may be requested of the Manufacturer if applicable.

2. Movement capabilities shall be clearly defined as a percentage of the nominal joint width or with distinct dimensions defined on product details.

B. Joint Systems shall allow for seismic movement (if applicable), matching requirements as defined within the Project Specific Structural Specifications.

C. Fire Rated Assemblies shall be tested by registered Third Party Testing Agencies in accordance with UL2079, ULC S115, EN 1366-4 or BS 476-10 classified systems. Expansion joint assembly fire rating shall match or exceed the fire rating of adjacent construction.

1.07 QUALITY ASSURANCE

A. Architectural Joint Cover Manufacturer: Furnish horizontal and vertical systems from a Manufacturer with a minimum of ten (10) years of experience in the design, engineering and fabrication of expansion joint systems.

- B. Fire Rated Assembly Manufacturer: Furnish horizontal and vertical rated systems from a single Manufacturer to ensure compatibility. Intersection of/ or transition between dissimilar systems is not allowed unless reviewed and approved by AHJ.
- C. Installer: Contractor with not less than three (3) years of successful experience in the installation of systems similar to those required by Project.

1.08 ACTION SUBMITTALS

- A. Manufacturer's Specifications, technical data, installation instructions, and detail drawings for each proposed system.
- B. Listings/ Certifications of all Fire Rated Assemblies secured through Registered Third Party Testing Agency.
- C. Representative sample of specified systems 4" [100mm] minimum length (if required by Project Architect)
- D. UL Environmental GreenGuard Gold Certification required for any Synthetic Rubber seals to be utilized in project. Ensure low VOC readings are reported by Third Party Registered Testing Agency for building projects with Health Care or Educational intent.

1.09 DELIVERY AND STORAGE

- A. Manufacturer to provide protective film on all exposed cover plate components.
- B. Deliver joint systems to jobsite in new, clean, unopened cartons or crates of sufficient size and strength to protect materials during transit.
- C. Inspect materials upon arrival. Store components in original containers in a clean, dry location. Ensure temperature or moisture sensitive components are stored in a tempered location.
- D. Contractor to provide temporary protective covers on all installed finished surfaces. Protection is required to guard against both surface abrasions as well as overloading of horizontal deck components by construction traffic.

1.10 SEQUENCING

- A. Submittals shall be completed and remitted to the Project Architect within 4 weeks after award of subcontract.
- B. Subcontract for the work of this section shall be planned to allow sufficient time for Manufacturer's production and delivery scheduling.

1.11 WARRANTY

- A. Standard JointMaster/InPro Corporation limited warranty against material and manufacturing defects for a period of not less than five (5) years when installed in accordance with Manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 MANUFACTURER

- A. Manufacturer must be capable of providing a full range Interior and Exterior Architectural Joint Cover systems as well as a full complement of expansion joint accessories.
- B. Manufacturer must be capable of providing project specific details accurate to the building construction type.
- C. Substitutions: To be reviewed by Architect of Record
- D. Requests for substitutions will be considered in accordance Section 016000

2.02 MATERIALS

- A. Aluminum: Alloy types of 6061-T6, 6063-T6, 6005A, or 5052-H32 sheet goods
 - 1. Floor systems: Mill finish standard
 - 2. Walls and Ceilings: Standard Class II Clear Anodized [Color Anodized, Kynar Painted, Custom Color Painted optional]
- B. Stainless Steel: Alloy Type 304 for plates and strips.
 - 1. Brushed #4 surface finish standard
- C. Elastomeric Seals: Synthetic rubber seals comprised of a dual extrusion Santoprene rubber for heat welding of all transitions and seams for a monolithic, weathertight installation. EPDM and Neoprene substitutions are not allowed due to their lack of ability to meet this specific requirement.
 - 1. All Santoprene seals must be certified as low VOC as certified by UL Environmental GreenGuard Gold Certification
- D. Horizontal and Vertical Moisture Barrier (optional accessory): Min. 45 mil thick fabric reinforced EPDM with optional watertight drain assemblies.
- E. Horizontal and Vertical Insulated Moisture Barrier (optional accessory):
 - 1. Min. R Value of 15
 - 2. Must meet ASTM E1399 Cyclic movement requirements matching movement requirements specific to project.

2.03.02 INTERIOR WALL AND CEILING JOINT SYSTEMS

- A. Single Flat Seal joint systems
 - 1. Recessed and Surface Mount framing systems
 - 2. Joint range applications 1-3" [25-75mm]
 - 3. Joint operating range 25%+- of total nominal joint width
 - 4. New and existing construction applications
 - 5. Santoprene Seal traits:
 - a. Achieves UL Greenguard Gold Certification for low VOC offgassing
 - b. Dual durometer extruded Santoprene with Shore Hardness of 60 Shore A and 40 Shore D to ensure longevity of installation. Single durometer seals shall not be allowed.
 - c. Flat seal must maintain inherent dimensional stability and include structural spine inserts (where applicable) allowing for additional load resistance.
 - d. Seals must be heat welded at butt seams and changes in direction
 - 6. Surface Mount system 116, 118 Series

2.03.05 EXTERIOR ROOF JOINT SYSTEMS

- A. Roof Expansion Joint Bellows System
 - 1. Standard Joint range applications 2-18" [50-450mm]
 - 2. Joint operating range 50%+- of total nominal joint width
 - 3. Flexible roofing membrane, supported by a closed cell foam sheetgood to form positive domed bellows. Afixed to flanges, adhered and mechanically fastened to substrate
 - a. Bellows: 0.060 in. (1.5 mm) thick non-reinforced EPDM, TPO, or PVC bellows adhered and mechanically combined to metal flanges by bifurcation process.

- b. Bellow Supports: Closed cell foam, 3/8 in. (9.5 mm) minimum thickness.
- c. Flange Metal: Hot dipped Galvanized, Stainless Steel, Aluminum, or Copper or flexible membrane for heatwelded seams.
- d. Provide matching factory-fabricated corners, transitions, intersections and terminations.
674 Series

2.03.06 ACCESSORY SYSTEMS

A. Fire Rated Barriers and Blanket Systems

- 1. Rated Fire Barrier system options ranging from 1-4 Hour Rating requirements with options meeting the following requirements:
- 2. Tested by Accredited Third Party Architectural Testing and Listing Agency in accordance with ASTM E814/119, E1966 and UL 2079 at its full rated period.
- 3. Product selection options:
 - d. Fireline F140 Series- 2 hour Fire Rated Blanket systems for small joint openings with 50%+- movement for seismic applications on joints 2- 4" [50-100mm] nominal width. Pre-attached flanges and male/female seam configuration. Patented compression installation spring system for non-invasive installation. Prefabricated male/ female seam configuration required for consistent fire protection. No mechanical fastening or continuous firecaulk required.

B. Moisture Barrier for vertical and horizontal applications

- 1. Reinforced EPDM 45 mil thk membrane with nylon mesh reinforcement. Optional drain fittings available in .375" and 1" inside diameter. On center spacing of drains to be determined by Plumbing Engineer of Record. Seams and directional transitions designed to ensure watertight seal and positive condensation drainage.

C. Insulated Thermal Moisture Barrier for vertical and horizontal applications

- 1. Reinforced EPDM 45 mil thk membranes sandwiching commercial grade batt insulation adhered and pinned together to resist slump and cyclic movement (movement must match the capabilities of the specified coverplate systems). Maintains R-value equivalent to the exterior and roof assemblies on project. Seams and directional transitions designed to ensure watertight seal and positive condensation drainage.
- 2. Submittal to include: ASTM test reports created by a certified third party Architectural product testing agency.

a. PRODUCT	TEST METHOD
Insulated Moisture Barrier	ASTM C1363 Thermal Performance
Test ASTM E283	Pressure Test for Rate of Air Leakage
ASTM E330	Dynamic Structural Performance Test

Test ASTM E331 Static Water Penetration

3. IVB Series

2.04 FABRICATION

- A. Field assemble components provided in standard lengths with pre-packaged fasteners and accessories whenever possible.

- B. Fabricate special transitions and corner fittings as required. Miter and heat weld elastomeric seals for monolithic splices and transitions.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Prior to starting work, verify that structural gap and blockout dimensions are in conformance with manufacturer's submittal data. Do not begin work until all unsatisfactory substrate conditions are resolved. See manufacturer for recommended tolerances.
- B. Carefully inspect installed work of other Trades and verify that such work is complete to allow the work of this section to commence.
- C. Schedule inspection of all Waterproofing measures and Fire Rated life safety product prior to installation of coverplate systems –or- provide allowance for removal of 10% of coverplate systems for inspection before final acceptance.

3.02 INSTALLATION

- A. Joint systems: Install in accordance with manufacturer's instructions.
- B. Align work plumb, level and flush with adjacent surfaces. Allowances should be made where actual structural gap at time of installation varies from nominal design gap. No shimming of frames is permitted.
- C. Coordinate with work of other Sections.
- D. If concrete blockouts (rebates) are required, ensure continuous support equal to surrounding substrate structural values.
- E. Fire Rated Assemblies: Where required, install to manufacturer's instructions.
- F. Moisture Barrier: Where required, install to manufacturer's instructions.

3.03 PROTECTION AND CLEANING

- A. Protect the completed Expansion Control system work from damage during construction.
Damage protection includes surface abrasion and overloading of coverplate by materials handling equipment and construction waste/debris,
- B. Protection from environmental factors required throughout installation process until Project Closeout. Protection includes but is not limited to rain events, moisture protection, exposure to temperature fluctuations or direct sunlight for temperature sensitive product offerings.
- C. Prior to project closeout, clean all exposed surfaces with a suitable cleaner. Manufacturer suggests Xylene for Santoprene seals, ensure non-solvent cleansers are not utilized throughout product lifespan.

END OF SECTION

0SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow-metal work.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required.
- E. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of hollow metal door and frame systems that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: One year from substantial completion.

1.6 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company
3. Steelcraft; an Ingersoll-Rand company.

1.7 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

1.8 INTERIOR FRAMES

- A. Standard-Duty Doors and Frames: SDI A250.8, Level 1.
 1. Physical Performance: Level C according to SDI A250.4.
 2. Frames:
 - a. Materials: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - b. Construction: Full profile welded.
 3. Exposed Finish: Factory primed.

1.9 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
 1. Physical Performance: Level B according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Seamless.
 - e. Core: Manufacturer's standard insulation material.
 3. Thermal-Rating: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

4. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
5. Exposed Finish: Factory Primed.

1.10 FRAME ANCHORS

- A. Jamb Anchors:
 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 3. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

1.11 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Glazing: Section 088000 "Glazing."

1.12 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
1. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

- c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
- 6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- E. Stops and Moldings: Provide stops and moldings around glazed lites. Form corners of stops and moldings with mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 3. Provide loose stops and moldings on inside of hollow-metal work.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

1.13 STEEL FINISHES

- A. Prime Finish: Clean, pre-treat, and apply manufacturer's standard primer.
 - 1. Shop Primer: SDI A250.10.
- B. Field Finish: Paint as specified for Steel Substrates in Section 099600 "High Performance Coatings"
 - 1. Color and Gloss: As selected by Architect.

1.14 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack un-faced fiber-glass insulation inside frames.
 4. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:

- a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.2 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic laminate faced doors.
- B. Product Data: For each type of door.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Fire-protection ratings of fire-rated doors.
- D. Samples: For plastic-laminate door faces.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS, GENERAL

- A. Contractor shall field verify information of existing solid wood doors to be matched, prior to bidding. Failure to perform said verification shall be the responsibility of the contractor.
- B. Quality Standard (Solid wood doors): In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
- C. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to **NFPA 252**.
 - 1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

2.2 PLASTIC-LAMINATE-FACED DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Algoma Hardwoods, Inc.
 2. Ampco.
 3. Graham Wood Doors; an Assa Abloy Group company.
 4. Oshkosh Door Company.
 5. VT Industries, Inc.
- B. Interior Solid-Core Doors:
1. Grade: Premium.
 2. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
 3. Colors, Patterns, and Finishes: As selected by Architect from laminate manufacturer's full range of products.
 4. Exposed Vertical Edges: Plastic laminate that matches faces, applied before faces.
 5. Core: Structural composite lumber.
 6. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and cross-bands are applied

2.3 FABRICATION

- A. Factory machine doors for hardware that is not surface applied.
- B. Openings: Factory cut and trim openings through doors.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Section 087111 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
1. Install fire-rated doors according to NFPA 80.
 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-

rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

- a. Comply with NFPA 80 for fire-rated doors.

- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

END OF SECTION 081416

SECTION 083600 - OVERHEAD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel Sectional Overhead Doors.
- B. Electric Operators and Controls.
- C. Operating Hardware, tracks, and support.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete.
- B. Section 04810 - Concrete Unit Masonry.
- C. Section 05500 - Metal Fabrications.
- D. Section 06114 - Wood Framing.
- E. Section 07900 - Joint Sealants.
- F. Section 08710 - Door Hardware.
- G. Section 09900 - Paints and Coatings.
- H. Section 11150 - Parking Control Equipment.
- I. Section 16130 - Raceway and Boxes.
- J. Section 16150 - Common Work Results for Electrical.

1.3 REFERENCES

- A. ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Wiring Connections: See electrical for requirements
 - 1. 115 volts, single phase, 60 Hz.
 - 2. 230 volts, single phase, 60 Hz.
 - 3. 230 volts, three phase, 60 Hz.
 - 4. 460 volts, three pha, 60 Hz.
- B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

- C. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturers' unopened labeled packaging until ready for installation.
- B. Protect materials from exposure to moisture until ready for installation.
- C. Store materials in a dry, ventilated, weathertight location.

1.8 PROJECT CONDITIONS

- A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.9 WARRANTY

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Subject to compliance with requirements, provide Overhead Door Corporation, 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: info@overheaddoor.com. Or comparable products by one of the following.

- 1. Cookson Company: Tel. 855.966.4361
- 2. Raynor: Tel. 815.288.1431
- 3. Wayne-Dalton Corp.:

- B. Requests for substitutions will be considered in accordance with provisions of Section 01600

2.2 STEEL SECTIONAL OVERHEAD DOORS

- A. Insulated Steel Sectional Overhead Doors: Model 423 Insulated Steel Doors by Overhead Door Corporation. Units shall have the following characteristics:

1. Door Assembly: Insulated steel door assembly of roll formed steel type with tongue and groove meeting rails and box shaped 20-gauge stile construction.
 - a. Panel Thickness: 2 inches (51 mm).
 - b. Exterior Surface: Ribbed.
 - c. Exterior Steel: 20-gauge, galvanized steel
 - d. Back Cover:
 - 1) .022-inch minimum embossed pre-painted white steel.
 - e. Center and End Stiles: 20 gauge steel.
 - f. Spring Counterbalance: Sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of diecast aluminum with high strength galvanized aircraft cable. Sized with a minimum 7 to 1 safety factor.
 - 1) Standard cycle spring: 10,000 cycles.
 - g. Insulation: 1-5/8 inch expanded polystyrene.
 - h. Thermal Values:
 - 1) Polystyrene - R-value of 7.64
2. Wind Load Design: Design as calculated in accordance with applicable code as follows:
 - a. Design pressure of plus 11.4 minus 12.7 psf at 9 feet 4 inches wide to 31.6/ minus 35.4 psf at 24 feet 2 inches wide.
 - b. Provide to meet FBC, TDI and Miami-Dade Specifications. Large Missile-Impact – Garage Doors up to 24 feet 2 inches wide
3. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
4. Lock:
 - a. Locking mechanism designed to maintain security for exterior while permitting break out when impacted from the inside.
5. Weatherstripping:
 - a. Flexible bulb-type strip at bottom section.
 - b. Flexible Jamb seals.
 - c. Flexible Header seal.
6. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
 - a. Size:
 - 1) 2 inches (51 mm).
 - b. Type:
 - 1) Standard lift.
7. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.

- a. Entrapment Protection: Required for momentary contact, includes radio control operation.
 - 1) Electric sensing edge monitored to meet UL 325/2010.
- b. Operator Controls:
 - 1) Push-button and key operated control stations with open, close, and stop buttons.
 - 2) Flush mounting.
- c. Special Operation:
 - 1) Card reader control.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until openings have been properly prepared.
- B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- C. Verify electric power is available and of correct characteristics.
- D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean adjacent surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.
- B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- C. Anchor assembly to wall construction and building framing without distortion or stress.
- D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- E. Fit and align door assembly including hardware.
- F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.4 CLEANING AND ADJUSTING

- A. Adjust door assembly to smooth operation and in full contact with weatherstripping.
- B. Clean doors, frames, glass, and polycarbonate according to manufacturer's instructions.
- C. Remove temporary labels and visible markings. Do not remove polycarbonate care and maintenance label required to maintain warranty.

3.5 PROTECTION

- A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.
- B. Protect installed products until completion of project.
- C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Exterior and interior manual-swing entrance doors.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.
1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples: For each exposed finish required.
- D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.
- B. Product test reports.
- C. Field quality-control reports.
- D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.

- e. Failure of operating units.
- B. Structural Loads: As required by the International Building Code, 2012 edition.
- C. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to $1/175$ of clear span for spans up to 13 feet 6 inches and to $1/240$ of clear span plus $1/4$ inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to $1/360$ of clear span or $1/8$ inch, whichever is smaller.
 - a. Operable Units: Provide a minimum $1/16$ -inch clearance between framing members and operable units.
 - 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than $1/240$ of clear span plus $1/4$ inch for spans greater than 11 feet 8- $1/4$ inches or $1/175$ times span, for spans less than 11 feet 8- $1/4$ inches.
- D. Structural: Test according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
 - 1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - b. Single Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
- F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.

- G. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an condensation resistance factor of no less than 68 for frames and 68 for glass as determined according to AAMA Specification 1503.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide Kawneer Co., Inc; Trifab VG 451, or comparable products by one of the following.
- a. Kawneer – 225.432.3615
 - b. Oldcastle Building Envelope – 214.273.3400
 - c. Manko – Manhattan, KS. 785.776.9643
 - d. YKK - Atlanta, GA. 678.945.6190

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
 2. Frame Size: 2 inches by 4-1/2 inches.
 3. Glazing System: Retained mechanically with gaskets on four sides.
 4. Glazing Plane: Center.
 5. Finish: As selected by Architect from the following:
 - a. AA-M10C21A44/AA-M45C22A44, AAMA 611, Architectural Class 1, Clear anodic finish.
 - b. Full range of manufacturers' standard AA-M10C21A44/AA-M45C22A44, AAMA 611, Architectural Class 1, Color anodic finishes.
 - c. Full range of manufacturers' standard AAMA 2605, 70% PVDF, Fluoropolymer Coatings.
 - d. Custom color AAMA 2605, 70% PVDF, Fluoropolymer Coating.
 6. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Basis-of-Design: Subject to compliance with requirements, provide Kawneer Co., Inc; Series 350 medium Stile, or comparable products by one of the following.
 - a. Kawneer
 - b. Oldcastle Building Envelope
 - c. Manko
- 2. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
- 3. Door Design: Medium stile; 3-1/2-inch nominal width.
- 4. Glazing Gaskets: Manufacturer's standard compression type, replaceable, extruded EPDM rubber.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
 2. Exterior Hinges: Stainless steel, with stainless-steel pin.
 3. Quantities:
 - a. For doors up to 87 inches high, provide three hinges per leaf.
 - b. For doors more than 87 and up to 120 inches high, provide four hinges per leaf.
- E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- F. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- G. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- H. Cylinders: As specified in Section 087100 "Door Hardware."
1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".
- I. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- J. Operating Trim: BHMA A156.6.

- K. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- L. Concealed Overhead Holders: BHMA A156.8, Grade 1.
- M. Doorstops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- N. Weather Stripping: Manufacturer's standard replaceable components.
- O. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- P. Silencers: BHMA A156.16, Grade 1.
- Q. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.6 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
- D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to the greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from interior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

- 1. Comply with manufacturer's written instructions.
- 2. Do not install damaged components.
- 3. Fit joints to produce hairline joints free of burrs and distortion.
- 4. Rigidly secure nonmovement joints.
- 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- 6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

- 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
- 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

- 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

END OF SECTION 084113

SECTION 084523 – 2 3/4” INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL WALL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the insulated, translucent sandwich panel system and accessories as shown and specified. Work includes providing and installing:
 - 1. **Flat** insulated, translucent sandwich panels
 - 2. Aluminum clampite installation system
 - 3. Aluminum sill flashing
- B. Related Sections:
 - 1. 012500 – Substitution Procedures
 - 2. 016000 – Product Requirements

1.2 SUBMITTALS

- A. Submit manufacturer's product data. Include construction details, material descriptions, profiles, and finishes of components.
- B. Submit shop drawings. Include plans, elevations, and details.
- C. Submit manufacturer's color charts showing the full range of colors available for factory finished exposed aluminum.
 - 1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below.
 - a. Sandwich panels: 7” x 12” units
- b. Factory finished aluminum: 3” long sections
- D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.
- E. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.
 - 1. Reports required (if applicable) are:
 - a. Flame Spread and Smoke Developed (UL 723) – Submit UL Card

- b. Burn Extent (ASTM D 635)
- c. Color Difference (ASTM D 2244)
- d. Impact Strength (UL 972)
- e. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)
- f. Bond Shear Strength (ASTM D 1002)
- g. Beam Bending Strength (ASTM E 72)
- h. Insulation U-Factor (NFRC 100)
- i. NFRC System U-Factor Certification (NFRC 700)
- j. NFRC Visible Light Transmittance (NFRC 202)
- k. Solar Heat Gain Coefficient (NFRC or Calculations)
- l. Condensation Resistance Factor (AAMA 1503) (Thermally Broken, insulated panels only)
- m. Air Leakage (ASTM E 283)
- n. Structural Performance (ASTM E 330)
- o. Water Penetration (ASTM E 331)

1.3 CLOSEOUT SUBMITTALS

- A. Provide field maintenance manual to include in project maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:

- 1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope, and location. At least three of the projects shall have been in successful use for ten years or longer.
- 2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural, and water infiltration testing of sandwich panel systems by an accredited agency.
- 3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components, and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.

- B. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing Kalwall panel systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope, and type.

1.5 PERFORMANCE REQUIREMENTS

- A. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1. When requested, include span analysis data.
2. Standard panel system shall have less than 0.01 cfm/ft² air leakage by ASTM E 283 at 6.24 PSF (50 mph) and no water penetration by ASTM E 331 at 15 PSF; and structural testing by ASTM E 330.
3. Structural Loads. Provide system capable of handling the following loads:

Wind Load (PSF): 35

B. Deflection Limits:

1. Walls: Limited to L/60 of clear span for each assembly component.

C. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 110 deg F (43 deg C), ambient; 150 deg F (66 deg C), material surfaces.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver panel system, components, and materials in manufacturer's standard protective packaging.
- B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

1.7 WARRANTY

- A. Provide manufacturer's and installer's written warranties agreeing to repair or replace panel system work, which fails in material or workmanship, within one year from the commencement date. The commencement date of the warranty shall be the date of substantial completion, but no more than six months from date of delivery. Failure of material or workmanship shall include deterioration of finish on metal in excess of normal weathering; and defects in accessories; insulated, translucent sandwich panels; and other components of the work
- B. Extended Panel Warranty:
 1. Panel Delamination: 10 years from the commencement date. The commencement date of the warranty shall be the date of substantial completion, but no more than six months from date of delivery.
 2. Face Sheet Color Change: 10 years from the commencement date. The commencement date of the warranty shall be the date of substantial completion, but no more than six months from date of delivery.

3. Face Sheet Fiberbloom: 20 years from the commencement date. The commencement date of the warranty shall be the date of substantial completion, but no more than six months from date of delivery.
- C. Extended Manufacturer's factory applied Finish Warranty: 10 years from the commencement date. The commencement date of the warranty shall be the date of substantial completion, but no more than six months from date of delivery.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis-of-Design: Subject to compliance with requirements, provide products manufactured by Kalwall Corporation or comparable products by one of the following. Kalwall Corporation, Tel: (800) 258-9777 – Fax: (603) 627-7905 – Email: info@kalwall.com. Distributor: Bufkin Building Specialties, Inc 601-927-9670
 1. Kingspan Phone - 479.670.6159 email - damon.brown@kingspan.com
 2. CRYSTAL STRUCTURES – Phone 316.838.0033 email - contactus@csglazing.net

2.2 PANEL COMPONENTS

- A. Face Sheets:
 1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
 - a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
 - b. Face sheets shall not deform, deflect, or drip when subjected to fire or flame.
 2. Interior face sheets:
 - a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 50 and smoke developed no greater than 450 when tested in accordance with UL 723.
 - b. Burn extent by ASTM D 635 shall be no greater than 1”.
 3. Exterior face sheets:
 - a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 5 years outdoor South Florida weathering at 5° facing south as measured on a white sample, with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
 - b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4” diameter, 5 lb. free-falling ball per UL 972.
 - c. Erosion Protection: Integral, embedded-glass erosion barrier.
 4. Appearance:

- a. Exterior face sheet: Smooth, .070 thick and color selected by owner.
- b. Interior face sheet: Smooth, .045 thick and color selected by owner.
- c. Face sheets shall not vary more than $\pm 10\%$ in thickness and be uniform in color.

B. Grid Core:

- 1. **Thermally Broken Composite** I-beam grid core shall be of alloy and temper recommended by manufacturer with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16".
- 2. I-beam Thermal break: Minimum 1", thermoset fiberglass composite. Poured and de-bridged thermal break is not acceptable.

C. Laminate Adhesive:

- 1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".
- 2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
- 3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:
 - a. 50% Relative Humidity at 68° F: 540 PSI
 - b. 182° F: 100 PSI
 - c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
 - d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.3 PANEL CONSTRUCTION

- A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.
 - 1. Thickness: 2-3/4 inches
 - 2. Grid Core Insulation: Fill panel cores with fiberglass batt
 - 3. Panel U-factor by NFRC certified laboratory:
- a. 2-3/4" thermally broken grid .23u
 - 4. Visible Light Transmittance (VLT): **26%**
 - 5. Solar heat gain coefficient .30
 - 6. Grid pattern as viewed on drawings: Nominal size 12 x 24 ; pattern shoji
- B. Standard panels shall deflect no more than 1.9" at 30 PSF in 10'-0" span without a supporting frame by ASTM E 72.

- C. Panels shall meet the conditions of acceptance according to ASTM E2707 Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure:
 - 1. Absence of flame penetration through the wall assembly at any time.
 - 2. Absence of evidence of glowing combustion on the interior surface of the assembly at the end of the 60-min observation period.
 - 3. Absence of evidence of flame, glow, and smoke if the test is terminated prior to the completion of the 60-min observation period.
- D. Thermally broken, insulated panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

2.4 ALUMINUM CLAMPTITE INSTALLATION SYSTEM

- A. Aluminum clamp-tite installation system:
 - 1. Thermally Broken clamp-tite screw type closure system shall be of extruded aluminum alloy and temper as recommended by manufacturer.
- B. Sealing tape: Manufacturer's standard, pre-applied to aluminum clamp-tite installation system at the factory under controlled conditions.
- C. Fasteners: 300 series stainless steel screws for aluminum clamp-tite installation system, excluding final fasteners to the building.
- D. Finish:
 - 1. Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be selected from manufacturers standard finishes
 - 2. Mill (optional)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Installer shall examine substrates, supporting structure, and installation conditions.
- B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by sealant manufacturer for this purpose.

2. Where aluminum will contact concrete, masonry, or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by sealant manufacturer.

3.3 INSTALLATION

- A. Install the panel system in accordance with the manufacturer's fabrication drawings and suggested installation instructions.
 1. Anchor component parts securely in place by permanent mechanical attachment system.
 2. Accommodate thermal and mechanical movements.
 3. Seal aluminum clampite installation system as shown on the manufacturer's fabrication drawings and suggested installation instructions.
- B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturers fabrication drawings and suggested installation instructions.

3.5 CLEANING

- A. Clean the panel system, interior and exterior, immediately after installation.
- B. Refer to manufacturer's written recommendations.

END OF SECTION 084523

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. The Contractor shall provide construction cores prior to the projects acceptance, and the University will be installing the permanent cores. All the hardware must accept Best Cormax cores. All locks and hardware must be able to accept Best Cormax cores without modification by the University.
2. Cylinders for door hardware specified in other Sections.

B. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.

1. Pivots, thresholds, weather stripping and lock cylinders to be installed under other Sections.
2. Verify keying system with owner prior to ordering and provide and install permanent cores.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each exposed product and for each color and texture specified.

C. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - b. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
 - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: See attached schedule.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- B. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- D. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

- b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch.
 - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- H. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
- 1. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
 - a. Exit Devices: Two years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" to comply with requirements in this Section.
- 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
- 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 - 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
- C. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- F. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- G. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. The Contractor shall provide construction cores prior to the projects acceptance, and the University will be installing the permanent cores. All the hardware must accept Best Cormax cores. All locks and hardware must be able to accept Best Cormax cores without modification by the University
 - a. Bid shall include hardware suppliers cost to install permanent cores.

- H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- I. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, where installation above accessible ceilings is not possible. Verify location with Architect.
 - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- J. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- K. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- L. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- M. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- N. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- O. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.2 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

3.3 DOOR HARDWARE SCHEDULE SEE 087100A



Finish Hardware Specification

for

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507 Filhoil Ave
Monroe, LA 71203

Architect: TBA Studio
, LA
USA

Supplier: Twin City Door & Hardware Inc.
3109 Concordia Ave.
Monroe, LA 71201
(318)323-8474 Fax: (318)323-8447
Phone:

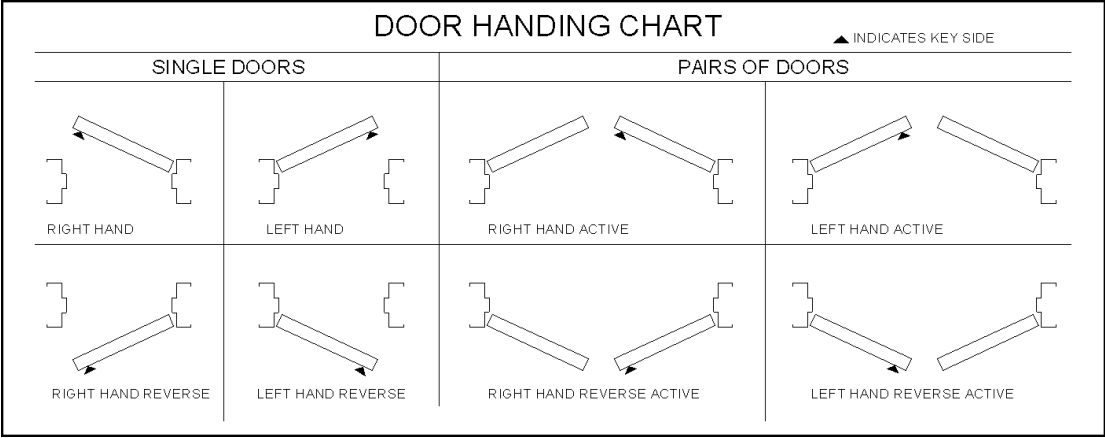
Job Number: VD91025

Date: September 18, 2025

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School of Construction Practice Lab Building, ULM

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Job Number: VD91025



General Notes:

Match existing campus key system

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Job Number: VD91025

Based On:

Hinge - (4-1/2 Std Wt(.134))	Stanley Hardware (STA)
Flush Bolt - Automatic (Corner)	Rockwood (ROC)
Removable Mullion	Precision Hardware, Inc. (PHI)
Cylinder	Best Access Systems (BEST)
Mortise Lockset	Best Access Systems (BEST)
Exit Device - Rim	Precision Hardware, Inc. (PHI)
Electric Strike	HES (HES)
Core	Best Access Systems (BEST)
Push Plate	Rockwood (ROC)
Push/Pull Set	Rockwood (ROC)
Coordinator - Gravity	Rockwood (ROC)
Closer	Dorma (DOR)
Kick Plate	Rockwood (ROC)
Wall Stop	Rockwood (ROC)
Floor Stop	Rockwood (ROC)
Overhead Holder/Stop (Surface)	Rockwood (ROC)
Weatherstrip	Pemko (PEM)
Astragal (Surface)	Rockwood (ROC)
Sweep	Pemko (PEM)
Threshold	Pemko (PEM)
Drip Cap	Pemko (PEM)
Electric Power Transfer	Precision Hardware, Inc. (PHI)
Power Supply	Precision Hardware, Inc. (PHI)
Silencer	Rockwood (ROC)

Finish Hardware Specification
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Job Number: VD91025

Hardware Finishes:

<u>Finish</u>	<u>Finish Description</u>
262	
26D	Satin Chromium Plated
32D	Satin Chromium Plated
600	Primed for Painting
626	Satin chromium plated over nickel
630	Satin stainless steel
689	Aluminum painted
Alum	Aluminum
Gray	Gray
Green	Gray
PRIMED	Gray
US26D	Satin chromium plated over nickel
US32D	Satin stainless steel

Finish Hardware Specification
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Job Number: VD91025

Door List

Door#	Hardware Set#
101	1
102	1
103	2
106	3
107	4
108	6
109	13
110	7
111	12
112	12
113	5
114	8
115	8
116	8
117	10
118	10
119	11
120	9
121	9



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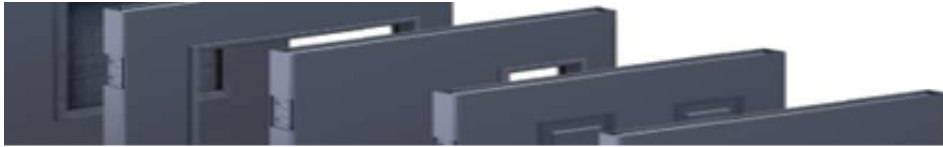
Job Number: VD91025

Finish Hardware Specification

Hardware Set#: 1

Single: 101, 102

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
3.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB191 4.5x4.5 NRP	32D
1.0	EA	PHI	Exit Device - Rim	2103 x 1700A	630
1.0	EA	DOR	Closer	8916 SPA FC SN1	689
1.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
1.0	EA	ROC	Floor Stop	470	US26D
1.0	EA	PEM	Weatherstrip	306AV 3684 TKSP	Alum
1.0	EA	PEM	Sweep	345AV 36 TKSP	Alum
1.0	EA	PEM	Threshold	2005AV 36" WS/PA	Alum
1.0	EA	PEM	Drip Cap	346C 40 TEK	Alum



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Job Number: VD91025

Finish Hardware Specification

Hardware Set#: 2

Single: 103

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
3.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB191 4.5x4.5 NRP	32D
1.0	EA	BEST	Cylinder	12E72RP	626
1.0	EA	PHI	Exit Device - Rim	2108 x V4908A	630
1.0	EA	BEST	Core	1CF72	626
1.0	EA	BEST	Core	1CC7A2 Green	Green
1.0	EA	DOR	Closer	8916 SPA FC SN1	689
1.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
1.0	EA	ROC	Floor Stop	470	US26D
1.0	EA	PEM	Weatherstrip	306AV 3684 TKSP	Alum
1.0	EA	PEM	Sweep	345AV 36 TKSP	Alum
1.0	EA	PEM	Threshold	2005AV 36" WS/PA	Alum
1.0	EA	PEM	Drip Cap	346C 40 TEK	Alum



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Job Number: VD91025

Finish Hardware Specification

Hardware Set#: 3

Single: 106

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
3.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB191 4.5x4.5 NRP	32D
1.0	EA	BEST	Cylinder	12E72RP	626
1.0	EA	PHI	Exit Device - Rim	2108 x V4908A	630
1.0	EA	HES	Electric Strike	9400	630
1.0	EA	BEST	Core	1CF72	626
1.0	EA	BEST	Core	1CC7A2 Green	Green
1.0	EA	DOR	Closer	8916 SDS FC SN1	689
1.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
1.0	EA	PEM	Weatherstrip	306AV 3684 TKSP	Alum
1.0	EA	PEM	Sweep	345AV 36 TKSP	Alum
1.0	EA	PEM	Threshold	2005AV 36" WS/PA	Alum
1.0	EA	PEM	Drip Cap	346C 40 TEK	Alum

-All other electrical components by security contractor.



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Job Number: VD91025

Finish Hardware Specification

Hardware Set#: 4

Pair: 107

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
6.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB191 4.5x4.5 NRP	32D
1.0	EA	PHI	Removable Mullion	KR822	600
3.0	EA	BEST	Cylinder	12E72RP	626
2.0	EA	PHI	Exit Device - Rim	MLR2108 x V4908A	630
3.0	EA	BEST	Core	1CF72	626
2.0	EA	BEST	Core	1CC7A2 Green	Green
2.0	EA	DOR	Closer	8916 SPA FC SN1	689
2.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
2.0	EA	ROC	Floor Stop	470	US26D
2.0	EA	PEM	Weatherstrip	306AV 3684 TKSP	Alum
2.0	EA	PEM	Sweep	345AV 36 TKSP	Alum
1.0	EA	PEM	Threshold	2005AV 72" WS/PA	Alum
1.0	EA	PEM	Drip Cap	346C 76 Tek	Alum
2.0	EA	PHI	Electric Power Transfer	EPT-5	262
1.0	EA	PHI	Power Supply	RPSMLR2	600

-All other electrical components by security contractor.



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Job Number: VD91025

Finish Hardware Specification

Hardware Set#: 5

Pair: 113

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
6.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB179 4.5x4.5	26D
1.0	EA	PHI	Removable Mullion	KR822	600
3.0	EA	BEST	Cylinder	12E72RP	626
2.0	EA	PHI	Exit Device - Rim	MLR2108 x V4908A	630
2.0	EA	BEST	Core	1CC7A2 Green	Green
3.0	EA	BEST	Core	1CF72	626
2.0	EA	DOR	Closer	8916 SPA FC SN1	689
2.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
2.0	EA	ROC	Floor Stop	470	US26D
2.0	EA	PHI	Electric Power Transfer	EPT-5	262
1.0	EA	PHI	Power Supply	RPSMLR2	600

All other electrical components by security contractor

Hardware Set#: 6

Pair: 108

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
6.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB179 4.5x4.5	26D
1.0	EA	PHI	Removable Mullion	KR822	600
3.0	EA	BEST	Cylinder	12E72RP	626
2.0	EA	PHI	Exit Device - Rim	FL2108 x V4908A	630
3.0	EA	BEST	Core	1CF72	626
2.0	EA	BEST	Core	1CC7A2 Green	Green
2.0	EA	DOR	Closer	8916 SDS FC SN1	689
2.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
2.0	EA	ROC	Floor Stop	470	US26D



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Job Number: VD91025

Finish Hardware Specification

Hardware Set#: 7

Single: 110

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
3.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB179 4.5x4.5	26D
3.0	EA	BEST	Cylinder	12E72RP	626
1.0	EA	BEST	Mortise Lockset	45H-7-D-14-J-626-1E74-Green	626
1.0	EA	ROC	Overhead Holder/Stop (Surface)	OH903S	US32D
3.0	EA	ROC	Silencer	608	Gray

Hardware Set#: 8

Single: 114, 115, 116

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
3.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB179 4.5x4.5	26D
1.0	EA	BEST	Cylinder	12E72RP	626
1.0	EA	BEST	Mortise Lockset	45H-7-D-14-J-626-1E74-Green	626
1.0	EA	DOR	Closer	8916 AF89 FC SN1	689
1.0	EA	ROC	Wall Stop	409	US32D
3.0	EA	ROC	Silencer	608	Gray



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Job Number: VD91025

Finish Hardware Specification

Hardware Set#: 9

Single: 120, 121

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
3.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB179 4.5x4.5	26D
1.0	EA	BEST	Cylinder	12E72RP	626
1.0	EA	BEST	Mortise Lockset	45H-7-D-14-J-626-1E74-Green	626
1.0	EA	ROC	Overhead Holder/Stop (Surface)	OH905S	US32D
3.0	EA	ROC	Silencer	608	Gray

Hardware Set#: 10

Single: 117, 118

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
3.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB179 4.5x4.5	26D
1.0	EA	BEST	Cylinder	12E72RP	626
1.0	EA	PHI	Exit Device - Rim	2108 x V4908A	630
1.0	EA	HES	Electric Strike	9400	630
1.0	EA	BEST	Core	1CF72	626
1.0	EA	BEST	Core	1CC7A2 Green	Green
1.0	EA	DOR	Closer	8916 SDS FC SN1	689
1.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
1.0	EA	ROC	Floor Stop	470	US26D

All other electrical components by security contractor



School of Construction Practice Lab Building, ULM

9/18/2025 10:54

Job Number: VD91025

Finish Hardware Specification

Hardware Set#: 11

Single: 119

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
3.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB179 4.5x4.5	26D
1.0	EA	BEST	Cylinder	12E72RP	626
1.0	EA	PHI	Exit Device - Rim	FL2108 x V4908A	630
1.0	EA	HES	Electric Strike	9400	630
1.0	EA	BEST	Core	1CF72	626
1.0	EA	BEST	Core	1CC7A2 Green	Green
1.0	EA	DOR	Closer	8916 SDS FC SN1	689
1.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
1.0	EA	ROC	Floor Stop	470	US26D

-All other electrical components by security contractor

Hardware Set#: 12

Single: 111, 112

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
3.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB179 4.5x4.5	26D
1.0	EA	ROC	Push Plate	70C	US32D
1.0	EA	ROC	Push/Pull Set	106x70C	US32D
1.0	EA	DOR	Closer	8916 AF89 FC SN1	689
1.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
1.0	EA	ROC	Wall Stop	409	US32D
3.0	EA	ROC	Silencer	608	Gray



School of Construction Practice Lab Building, ULM

9/18/2025 10:54

Job Number: VD91025

Finish Hardware Specification

Hardware Set#: 13

Pair: 109

<u>Qty</u>	<u>UOM</u>	<u>Manf</u>	<u>Item Type</u>	<u>Item Series/Description</u>	<u>Finish</u>
6.0	EA	STA	Hinge - (4-1/2 Std Wt(.134))	FBB179 4.5x4.5	26D
2.0	EA	ROC	Flush Bolt - Automatic (Corner)	2962	626
1.0	EA	BEST	Mortise Lockset	45H-7-R-14-J-626-1E74-Green	626
1.0	EA	BEST	Core	1CF72	626
1.0	EA	ROC	Coordinator - Gravity	576	US26D
2.0	EA	DOR	Closer	8916 SDS FC SN1	689
2.0	EA	ROC	Kick Plate	K1050 12 x 34 CSK BEV TEK	US32D
1.0	EA	ROC	Astragal (Surface)	306B-AST-UL	PRIMED
1.0	EA	ROC	Astragal (Surface)	306B-UL	PRIMED

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
1. Doors.
 2. Storefront framing.
 3. Glazed entrances.
 4. Interior borrowed lites.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 and ICC's 2012 International Building Code by a qualified professional engineer, using the following design criteria:
1. Design Wind Pressures: As required by ICC's 2012 International Building Code.
 2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 3. Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass to resist each of the following combinations of loads:
 - a. Outward design wind pressure minus the weight of the glass. Base design on glass type factors for short-duration load.
 - b. Inward design wind pressure plus the weight of the glass plus half of the design snow load. Base design on glass type factors for short-duration load.
 - c. Half of the inward design wind pressure plus the weight of the glass plus the design snow load. Base design on glass type factors for long-duration load.
 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.4 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Preconstruction adhesion and compatibility test report.

1.6 QUALITY ASSURANCE

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.
- D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from

normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
- B. Strength: Provide fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

2.3 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, provide products indicated on drawings.
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

2.4 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. EPDM complying with ASTM C 864.
 - 3. Silicone complying with ASTM C 1115.
 - 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer

rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 MONOLITHIC-GLASS TYPES

- A. Glass Type (Exterior Hollow Metal doors): Clear fully tempered float glass.
1. Thickness: 1/2 inch.
 2. Low-E.
 3. Visible Light Transmittance: 35%
 4. Summer Daytime U-Factor 0.27 maximum.
 5. Winter Night Time U-Value: 0.29 maximum.
 6. Solar Heat Gain Coefficient: 0.25 maximum.
- B. Provide safety glazing labeling.

- C. Glass Type (Interior Hollow Metal doors): Clear fully tempered float glass.
 - 1. Thickness: 1/4 inch.
 - 2. Provide safety glazing labeling.
- D. Glass Type (Interior Aluminum Entrances and Storefronts): Clear Fully tempered float glass.
 - 1. Thickness: 1/4 inch.
 - 2. Provide safety glazing labeling.
- E. Glass Type (Interior Borrowed Lites): Clear Fully tempered float glass.
 - 1. Thickness: 1/4 inch.
 - 2. Provide safety glazing labeling.
- F. Heat strengthen 7/16" glass in aluminum framing with level 1 bullet resistant Glass see drawings for location. **NOT USED.**

2.9 INSULATING-GLASS TYPE (EXTERIOR STOREFRONT GLAZING)

- A. Vitro Glass Type (Exterior Storefront Glazing): Solar Control Tinted Insulating Glass - Solarban R100 (2) Optigray + Clear by Vitro Architectural Glass. Spandrel glass shall be Optigray + Solarban R100 (2) Spandrel number 3-8009 Cliffside Nest.
 - 1. Overall Unit Thickness: 1 inch.
 - 2. Thickness of Glass Lite: 1/4- inch glass + 1/2- inch air space + 1/4-inch glass
 - 3. Outdoor Lite: R100 (2) Optigray + Clear
Spandrel 3-8009 - Cliffside Nest – (See exterior elevations on drawings for location).
 - 4. Interspace Content: Air.
 - 5. Indoor Lite: Clear fully tempered float glass.
 - 6. Low-E Coating: location by Vitro.
 - 7. Visible Light Transmittance: 29 percent minimum.
 - 8. Winter Nighttime U-Factor: 0.29 maximum.
 - 9. Summer Daytime U-Factor: 0.27 maximum.
 - 10. Solar Heat Gain Coefficient: 0.20 maximum.
 - 11. Shading Coefficient: 0.23
 - 12. Outdoor Visible Light Reflectance: 18%

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tape to heads and sills first and then to jambs. Cover horizontal framing joints by applying tape to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Apply heel bead of elastomeric sealant.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 088000

SECTION 088813: FIRE-RATED GLAZING and FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Fire rated glazing

1. SuperLite® II-XL 60 fire resistive, safety rated glazing material for interior and exterior applications.
2. Applications of fire rated glazing includes:
 - a. Fire rated glazing as door vision lites, sidelites, borrowed lites, windows, transoms and transparent wall applications in fire rated frames.

B. Related sections:

1. Section 01 33 23: Shop Drawings, Product Data and Samples
2. Section 08 80 00: Glazing
3. Section 08 88 00: Special Function Glazing
4. Section 08 11 13: Hollow Metal Doors and Frames
5. Section 08 11 16: Aluminum Doors and Frames
6. Section 08 12 16.13: Fire-Rated Aluminum Frames
7. Section 08 14 33: Stile and Rail Wood Doors
8. Section 08 41 13.13: Fire-Rated Aluminum Framed Entrances and Storefronts
9. Section 08 43 13.13: Fire-Rated Aluminum Storefronts
10. Section 08 44 13: Glazed Aluminum Curtain Walls
11. Section 08 44 18: Glazed Steel Curtain Walls

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E119: Methods for Fire Tests of Building Construction and Materials.
2. ASTM E152: Methods for Fire Tests of Door Assemblies.
3. ASTM E163: Methods for Fire Tests of Window Assemblies.
4. ASTM E2074: Standard Test Method for Fire Tests of Door Assemblies, including Positive Pressure Testing of Side-hinged and Pivoted Swinging Door Assemblies.
5. ASTM E2010-1: Standard Test for Positive Pressure of Fire Tests of Window Assemblies.

B. National fire Protection Association (NFPA):

1. NFPA 80: Fire Doors and Windows.
2. NFPA 251: Fire Tests of Building Construction and Materials.
3. NFPA 252: Fire Tests of Door Assemblies.
4. NFPA 257: Fire Tests of Window Assemblies.

C. Underwriters Laboratories, Inc. (UL):

1. UL 9: Standard for Safety of Fire Tests of Window Assemblies.

2. UL 10 B: Standard for Safety of Fire Tests of Door Assemblies.
 3. UL 10 C: Standard for Safety of Positive Pressure Tests of Door Assemblies.
 4. UL 263: Fire Tests of Building Construction and Materials.
- D. Standard Council of Canada:
1. ULC Standard CAN4-S101: Fire Tests of Building Construction and Materials.
 2. ULC Standard CAN4-S104: Fire Tests of Door Assemblies.
 3. ULC Standard CAN4-S106: Fire Tests of Window Assemblies.
- E. Consumer Product Safety Commission (CPSC):
1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials.
- F. Glass Association of North America (GANA)
1. GANA – Glazing Manual.
 2. FGMA – Sealant Manual.
- G. National Fenestration Rating Council (NFRC)
1. NFRC 100: Procedure for Determining Fenestration Product U-Factors.
 2. NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- H. [American Recovery and Reinvestment Act
1. Section 1605, Title XVI Buy American Provision]
- I. [Insert building code used by Authority Having Jurisdiction]

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide a fire rated glazing manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1. Fire Rating: 60 minutes with hose stream.
2. Fire resistive, safety rated glazing tested in accordance with ASTM E119, NFPA 80, NFPA 251, NFPA 252, NFPA 257, UL 9, UL 10B, UL 10C and UL 263.
3. Testing Laboratory: Fire test shall be conducted by a nationally recognized independent testing laboratory.

A. Listings and Labels:

1. Fire rated glazing shall be under current follow-up services by nationally recognized independent testing laboratory approved by OSHA and maintain a current listing or certification. Assemblies shall be labeled in accordance with limits of listings.

1.04 SUBMITTALS

A. . Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedure Section.

1. Shop Drawings: Submit shop drawings showing layouts, profiles and product components.
2. Samples: Submit 12x12 glass samples.
3. Technical Information: Submit latest edition of manufacturer's product data.

1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Comply with Division 1 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- C. Delivery: Deliver materials to specified destinations in manufacturer or distributor's packaging.
- D. Storage and Protection: Store off ground, under cover, protected from weather and construction activities and at temperature conditions recommended by manufacturer.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual measurements for openings by field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.07 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document. Manufacturer's warranty is not intended to limit other rights that the Owner may have under the Contract Documents.
 - 1. Warranty Period: 5-year limited warranty from date of shipping.

PART 2 PRODUCTS

2.01 FIRE RATED GLAZING

- A. BASIS of DESIGN: Subject to compliance with requirements, provide SuperLite II-XL 60-minute fire resistive, safety rated glazing and framing.
- B. Manufacturer: SuperLite II-XL as manufactured and distributed by SAFTI*FIRST*.
 - 1. Contact: 100 N Hill Drive, Suite 12, Brisbane, CA 94005; Telephone 888.653.3333; email info@safti.com; Web site www.safti.com. Or by one of the following.
 - a. FYRE TEC – Tel. 402.396.2711
 - b. TGP Technical Glass Products - Tel. 800.426.0279
 - 2. Fire rated glass and framing must be provided by a single-source, US manufacturer. Distributors of fire rated glass and framing will not to be considered as manufacturers.
- C. Design Requirements:
 - 1. Make-up: Must be comprised of an inboard and outboard lite of [clear tempered] [Starphire Ultra-Clear[®] glass by Vitro] protecting a clear, fire resistive,

- intumescent interlayer.
2. Thickness: 1-3/8" (35 mm) standard profile.
 3. Weight: 14-lbs/sq. for standard 1-3/8" (35 mm) standard profile.
 4. Sound Transmission Rating: Must meet 43 STC/39 OITC in 1-3/8" standard profile; Must meet 43 STC/ 37 OITC insulated with 1/4" Low-E.
 5. Dimensions: Must meet max. clear view area of 4,952 sq. in., measuring at least 124 in. on the long side.
 6. Appearance: Must be tint-free, optically clear fire resistive glazing.
 7. Visible Transmittance: Must meet 0.786 with clear standard; 0.877 with clear low-iron.
 8. Fire Rating: Must be fire rated to 60 minutes with hose stream and meet ASTM E-119.
 9. Impact Safety Resistance: CPSC 16 CFR 1201 Cat. I & II.
 10. Hard Body Impact Classification: Must meet ASTM C1629/C1629M Level 3.
 11. Soft Body Impact Classification: Must meet ASTM E695 Level 3.
 12. Surface Abrasion Resistance: Must meet ASTM D4977 Level 3.
 13. Customization: Available in insulated, energy performance, bullet-resistant, blast-resistant, hurricane-resistant, laminated, tinted, patterned, frosted, mirrored, reflective, segmented, decorative and more.

D. Manufacturer's Fire Rated Glazing Material:

1. Each piece of fire-rated glazing material shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory, fire rating period and safety glazing standards.
2. Glazing materials installed in Hazardous Locations, subject to human impact, shall be certified and permanently labeled as meeting applicable requirements reference in NFPA 80:
 - a) CPSC 16 CFR 1201 Cat. I & I

2.02 MATERIALS

A. Glazing Accessories: Manufacturer recommended fire rated glazing accessory as follows:

- a. Glazing with EPDM tape or other listed flame resistant gasket material and calcium silicate setting blocks.

2.03 RELATED PRODUCTS

A. Glazing shall be installed in an equally rated framing system.

B. Pressure glazing is allowed.

2.04 SOURCE QUALITY

A. Obtain fire rated glazing products from a single manufacturer.

B. Fabrication Dimensions: Fabricate to approved dimensions. The general contractor shall guarantee dimensions where practicable within required tolerances.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data including product technical bulletins and installation instructions.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, have been previously installed under other sections, and are acceptable for product installation in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Installation shall be in strict accordance with the fire glazing material manufacturer's specifications. Field cutting or tampering is strictly prohibited.

3.04 CLEANING AND PROTECTION

- A. Protect glass from contact with contaminating substances resulting from construction operations. Remove such substances by method approved by manufacturer.
- B. Wash glass on both faces not more than four days prior to date schedule for inspections intended to establish date of Substantial Completion. Wash glass by method recommended by glass manufacturer.
- C. Remove temporary coverings and protection of adjacent work areas.
- D. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

SECTION 090561.13 – MOISTURE VAPOR EMISSION CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes application of polymer-based, high-solids, water-based moisture control and primer system for underlayments.

B. Related Requirements:

1. Section 03 35 00 – Concrete Finishing.
2. Section 03 54 16 – Hydraulic Cement Underlayment.
3. Section 09 65 00 – Resilient Flooring.

1.2 REFERENCES

A. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

B. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs.

C. ASTM F3010 – Two-Component Vapor-Permeability Systems.

D. ASTM F3513 – One-Component Vapor-Permeability Systems.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical data and installation instructions.

B. Safety Data Sheets (SDS).

C. Certification of compliance with ASTM standards.

1.4 QUALITY ASSURANCE

A. Manufacturer qualifications: 10 years minimum producing moisture mitigation systems.

B. Installer qualifications: Minimum 2 years experience with resinous flooring systems.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in unopened containers with manufacturer's labels intact.

B. Store between 50°F and 90°F. Protect from freezing.

1.6 FIELD CONDITIONS

- A. Do not install when ambient or substrate temperature is below 50°F.
- B. Substrate temperature must be at least 5°F above dew point.

1.6 FIELD CONDITIONS

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PART 2 – PRODUCTS

2.1 BASIS OF DESIGN: Subject to compliance with requirements, provide Planiseal Max by Mapei Corporation 1144 East Newport Center Drive Deerfield, FL. 33442 Ph. 1.888.876.2734 or by one of the following.

- A. Koster American Corp. Ph. 757.425.1206
- B. Maxxon Corp. 1.800.238.8461 or 1.800.878.5586

2.2 MATERIALS

- A. One-component, high-solids, water-based, polymer moisture mitigation coating with textured surface.
- B. Color: Burgundy.
- C. VOC Content: <50 g/L.

2.3 PERFORMANCE REQUIREMENTS

- A. Moisture vapor emission: Up to 25 lb/1000 ft²/24 h (ASTM F1869).
- B. Relative humidity: Up to 100% (ASTM F2170).
- C. pH resistance: Up to 14.
- D. Water vapor permeance: <0.1 perms (ASTM E96).

2.4 PACKAGING

- A. 4-gallon (15.1 L) pails.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify substrate is structurally sound, porous, and free of contaminants.
- B. Verify moisture and pH testing is complete.

3.2 SURFACE PREPARATION

- A. Mechanically prepare substrate to ICRI CSP 1 minimum.
- B. Clean surface of dust and debris before application.

3.3 APPLICATION

- A. Mix: Stir gently before use.
- B. Apply two coats by roller at 200 ft²/gal per coat.
- C. Allow 30 minutes between coats, dry to touch.
- D. Allow 1–2 hours cure time before applying underlayment or adhesive.

3.4 PROTECTION

- A. Protect finished surface from traffic until covered with subsequent flooring.

3.5 CLEANING

- A. Clean tools with water immediately after use.

END OF SECTION

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.

2.2 FRAMING SYSTEMS

- A. General: Where structural drawings/notes indicate a thicker base-metal thickness (heavier gauge) or wider flange, the structural drawings/notes shall govern.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Allied Studco, Inc.
 2. ClarkDietrich Building Systems.
 3. Marino Ware Industries.
 4. The Steel Network, Inc.
 5. Unimast Incorporated.
 6. Delta Metal Products.
- C. Interior Partition Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
 1. Minimum Base-Metal Thickness: 0.0205 inch.
 2. Flange: 1-1/4 inch.
 3. Web Width: As indicated on drawings.
- D. Exterior Wall Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.

1. Minimum Base-Metal Thickness: 0.0312 inch.
 2. Flange: 1-1/4 inch.
 3. Web Width: As indicated on drawings.
- E. Cold-Rolled Channel Bridging: Steel, 0.053 inch minimum base-metal thickness, with minimum 1/2-inch wide flanges.
1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.

2.3 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacing indicated, but not less than spacing required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 2. 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.
- E. 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

SECTION 092400 - CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior portland cement plasterwork (stucco) on metal lath.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.
- C. Samples: For each type of factory-prepared finish coat indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Sound-Transmission Characteristics: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.
- C. Mockups: Before plastering, install mockups of at least 25 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 PROJECT CONDITIONS

- A. Comply with ASTM C 926 requirements.
- B. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

- A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
 - 1. Diamond-Mesh Lath: Self-furring, 3.4 lb/sq. yd.
 - 2. CEMCO - California Expanded Metal Products Co.
 - 3. ClarkDietrich

2.2 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:
 - 1. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 zinc coating.
 - 2. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
 - 3. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
 - 4. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.
 - a. Small-nose style; use unless otherwise indicated.
 - 5. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
 - 6. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - 7. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.

2.3 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.
- C. Bonding Compound: ASTM C 932.

- D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
- E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
- F. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

2.4 PLASTER MATERIALS

- A. Factory Prepared Cement Plaster Base and Scratch Coats: Quickcrete; One Coat Fiberglass Reinforced Stucco.
 - 1. Color for Finish Coats: As selected by Architect from manufacturer's full range.
- B. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.
 - 1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.2 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
- B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.
- C. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.3 INSTALLING METAL LATH

- A. Expanded-Metal Lath: Install according to ASTM C 1063.

1. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

3.4 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners:
 1. Install lath-type, external-corner reinforcement at exterior locations.
 2. Install cornerbead at interior and exterior locations.
- C. Control Joints: Install control joints in specific locations approved by Architect for visual effect as follows:
 1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Vertical Surfaces: 144 sq. ft.
 - b. Horizontal and other Non-vertical Surfaces: 100 sq. ft.
 2. At distances between control joints of not greater than 18 feet o.c.
 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 4. Where control joints occur in surface of construction directly behind plaster.
 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.5 PLASTER REPAIRS

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

END OF SECTION 092400

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Texture finishes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. Textured Finishes: 24-inch by 24-inch for each textured finish indicated and on same backing indicated for Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Certainteed.
2. James Hardie Building Products, Inc.
3. National Gypsum Company.
4. Temple-Inland.
5. United States Gypsum Company.
6. ClarkDietrich Building Systems.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M. See drawings for fire rated wall locations.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Gypsum Walls/Ceiling/Furr-down Boards: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

D. Hi-Impact XP Gypsum Board with fiberglass scrim: Hi-Impact Type X where required see drawings for fire rated wall locations.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

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.

2.5 AUXILIARY MATERIALS

A. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

B. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

2.6 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Non-Aggregate Finish: Pre-mixed, vinyl texture finish for spray application.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; ProRoc Easi-Tex Spray Texture.
 - b. National Gypsum Company; Perfect Spray EM Texture.

c. USG Corporation; BEADEX FasTex Wall and Ceiling Spray Texture.

2. Texture: As selected by Architect.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. Install trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 - 1. Control Joints: Install control joints, according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- E. Pre-fill open joints and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Texture Finish Application: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Mix and apply finish using powered spray equipment, to produce a uniform texture, matching approved mockup, and free of starved spots or other evidence of thin application or of application patterns.
- H. Protect adjacent surfaces from drywall compound and texture finishes and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- I. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Stone thresholds.
3. Waterproof membrane.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
3. Stone thresholds in 4 inch lengths.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

- A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide **American Olean** or comparable products by one of the following.
 - a. Concept Surfaces
 - b. Crossville
 - c. Daltile

All Colors and finishes are subject to approval by architect.

Porcelain Floor Tile (PFT)– Union

- 1. Size: 24” inch by 48” inch.
 - 2. Color: To be determined by architect from Manufacturer’s full range of colors
 - 3. Finish: UPS
 - 4. Grout: Laticrete
 - 5. Trim Units: As indicated on drawings or required.
 - 6. Cove Base, provide Schluter Dilex trim or equal. Architect to select color from manufacturer’s full range of colors and finishes.
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **Marazzi** or comparable products by one of the following.
 - a. Concept surfaces
 - b. Crossville
 - c. American Olean

All Colors and finishes are subject to approval by architect.

Porcelain Wall Tile (PWT) – Materika

- 1. Size: 16” inch by 48” inch
- 2. Finish: Matte
- 3. Color: To be determined by architect from Manufacturer’s full range of colors
- 4. Grout: Laticrete
- 5. Trim Units: As indicated on drawings.
- 6. Cove Base, provide Schluter Dilex trim or equal. Architect to select color from manufacturer’s full range of colors and finishes.

2.2 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.
 - 1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.3 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated.
- B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 - 1. Products: Subject to compliance with requirements, [provide one of the following]
 - a. Bostik, Inc.; Durabond D-222 Duraguard Membrane.
 - b. C-Cure; Pro-Red Waterproofing Membrane 63.
 - c. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane.
 - d. Laticrete International, Inc.; Latapoxy 24hr HydroProofing.
 - e. MAPEI Corporation; Mapelastic HPG.
 - f. TEC, a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.

2.4 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Bostik, Inc.
 - c. C-Cure.
 - d. Custom Building Products.
 - e. Laticrete International, Inc.
 - f. MAPEI Corporation.
 - g. Mer-Kote Products, Inc.
 - h. TEC; a subsidiary of H. B. Fuller Company.
 - 2. Prepackaged, dry-mortar mix to which only water must be added.
 - 3. For wall applications, provide nonsagging mortar.

2.5 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Boiardi Products; a QEP company.
 - b. Bonsal American; an Oldcastle company.
 - c. Bostik, Inc.
 - d. C-Cure.
 - e. Custom Building Products.
 - f. Laticrete International, Inc.
 - g. MAPEI Corporation.

2.6 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bonsal American, an Oldcastle company; Grout Sealer.
 - b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
 - c. C-Cure; Penetrating Sealer 978.
 - d. Custom Building Products; Surfaceguard Sealer.
 - e. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
 - f. TEC, a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.
- C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- F. Joint Widths: Unless otherwise indicated or otherwise recommended by tile manufacturer, install tile with the following joint widths:
 - 1. Wall Tile: 1/16 inch.
 - 2. Floor Tile: 1/16 inch.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
- J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors and tile floor wall bases according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- K. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

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.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Evaluation reports.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical ceiling area as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANEL CEILINGS, GENERAL

- A. Acoustical Panel Standard: Comply with ASTM E 1264.
- B. Metal Suspension System Standard: Comply with ASTM C 635.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.3 ACOUSTICAL PANELS (ACT-1)

- A. Basis-of-Design Product : Subject to compliance with requirements, provide Armstrong World Industries, Inc.; 1728 "Fine Fissured" or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. Chicago Metallic Corporation.
 - 3. Tectum Inc.
 - 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Color: White.
- C. LR: 0.85.
- D. NRC: 0.70, Type E-400 mounting according to ASTM E 795.
- E. CAC: 35.
- F. Edge/Joint Detail: Square.
- G. Thickness: 3/4 inch.
- H. Modular Size: 24 by 24 inches.

2.4 ACOUSTICAL PANELS (ACT-2)

- A. Basis-of-Design Product : Subject to compliance with requirements, provide CertainTeed; AQUAROCK 1182-CRF-1SV or comparable product by one of the following:

1. Armstrong World Industries, Inc.
 2. Chicago Metallic Corporation.
 3. Tectum Inc.
 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Color: White.
- C. LR: 0.78.
- D. CAC: 40.
- E. Edge/Joint Detail: Square.
- F. Thickness: 1/2 inch.
- G. Modular Size: 24 by 24 inches.

2.5 METAL SUSPENSION SYSTEM (ACT-1)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc.; “Prelude Plus XL Fire Guard” or comparable product by one of the following:
1. CertainTeed Corp.
 2. Chicago Metallic Corporation.
 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. 15/16” Tee System, Capped, Double-web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16 inch wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
 2. End Condition of Cross Runners: Override (stepped) type.
 3. Face Design: Flat, flush.
 4. Cap Material: aluminum cold-rolled sheet.
 5. Cap Finish: Baked Polyester painted, white.
- C. 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.

2.6 METAL SUSPENSION SYSTEM (ACT-2)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed.; “EZ Stab Classic Environmental System” or comparable product by one of the following:
1. Armstrong World Industries, Inc.
 2. Chicago Metallic Corporation.
 3. USG Interiors, Inc.; Subsidiary of USG Corporation.

- B. 15/16" Tee System, Capped, Double-web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized according to ASTM A 653/A 653M, not less than G60 coating designation; with prefinished 15/16 inch wide metal caps on flanges.
 - 1. Structural Classification: Heavy-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: aluminum cold-rolled sheet.
 - 5. Cap Finish: Baked Polyester painted, white.
- C. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.
 - 1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.

1.2 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 4 inches long.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. FloorScore Compliance: Resilient base shall comply with requirements of FloorScore certification.

2.2 THERMOPLASTIC-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burke Flooring (Flexco).
2. Nora Rubber Products.
3. Roppe Corp.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

C. Thickness: 0.125 inch.

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

- H. Colors: Up to four (4) as selected by Architect from manufacturer's full range, within same Collection/Series as indicated on drawings.

2.3 RUBBER STAIR ACCESSORIES

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Basis-of-Design Product: Subject to compliance with requirements, Johnsonite; Stairwell Management VIRTR-RD or comparable product by one of the following:
 - 1. AB; American Biltrite.
 - 2. Armstrong World Industries, Inc.
 - 3. Burke Mercer Flooring Products, Division of Burke Industries Inc.
 - 4. Flexco.
 - 5. Johnsonite; A Tarkett Company.
 - 6. Roppe Corporation, USA.
- C. Stair Treads: ASTM F 2169.
 - 1. Type: Rubber with integrated riser.
 - 2. Class: 2 (pattern; embossed, grooved, or ribbed).
 - 3. Group: 2 (with contrasting color for the visually impaired).
- D. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
- E. Locations: Provide rubber stair accessories in areas indicated.
- F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners: Job-formed corners are not acceptable

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING (LVT)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples: Full-size units of each color and pattern of floor tile required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.

2.2 Luxury Vinyl Composite Tile (LVT -1)

A. Basis-of-Design: Subject to compliance with requirements, provide Interface Level Set Collection Stones 19.69"x19.69" products or comparable products by one of the following:

1. Mohawk
2. EF Contract
3. Tarkett

- B. Color: As selected by Architect from manufacturer's full range, within series/collection.

2.3 Luxury Vinyl Composite Tile (LVT -2)

- A. Basis-of-Design: Subject to compliance with requirements, provide Interface Brushed Lines 9.845"x39.38" products or comparable products by one of the following:
 - 1. Mohawk
 - 2. EF Contract
 - 3. Tarkett

2.4 Luxury Vinyl Composite Tile (LVT -3)

- A. Basis-of-Design: Subject to compliance with requirements, provide Interface Brushed Lines 9.845"x39.38" products or comparable products by one of the following:
 - 1. Mohawk
 - 2. EF Contract
 - 3. Tarkett

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by 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.
 - 1. Adhesives shall comply with the following limits for VOC content:
 - a. Tile Adhesives: 50 g/L or less.
 - b. Rubber Floor Adhesives: 60 g/L or less.

PART 3 - EXECUTION

3.1 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 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 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 in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Floor Polish for LVT: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply two coat(s).
- C. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular, carpet tile.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Type of subfloor.
 - 3. Type of installation.
 - 4. Pattern of installation.
 - 5. Pattern type, location, and direction.
 - 6. Pile direction.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association.

- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.8 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

1.9 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 2. No Edge Ravel-No Sealer required to guarantee no edge ravel at edge or seams under normal use for life of carpet.
 3. No delamination-Guaranteed for Life.
 4. 20 lb. Tuft bind-Guaranteed for Life.
 5. Carpet installed over pad or glued directly to floor requires use of no chair pads. Backing guaranteed not to delaminate.
 6. Carpet impervious to water. Must meet British Spill Test Method E”.

PART 2 - PRODUCTS

2.1 CARPET TILE PRODUCTS

A. CARPET TILE: **CPT-1**

1. Basis-of-Design Product: Subject to compliance with requirements, provide Interface; Style: Combined Effect Collection. Size: 9.845 inch x 39.38 inch. Color/Pattern: As selected by Architect from full range of the Basis-of-Design.
2. Provide product indicated or comparable product by one of the following:
 - a. Patcraft
 - b. Shaw Contract
 - c. Mannington

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- E. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- F. Installation Method: As recommended in writing by carpet tile manufacturer.
- G. Maintain dye lot integrity. Do not mix dye lots in same area.
- H. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- I. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- J. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- K. Install pattern as indicated by drawings.
- L. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.

- M. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

END OF SECTION 096813

SECTION 099000 – PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, and varnishes.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
- D. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically so indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.
- E. See Schedule of finishes included in this Section.

1.02 RELATED REQUIREMENTS

- A. Section 02581 - Traffic Paint: Pavement markings.
- B. Section 03356 - Concrete Floor Finishing.
- C. Section 055000 - Metal Fabrications: Shop-primed items.
- D. Section 06100 - Rough Carpentry: Exposed telephone and electrical panel boards.
- E. Section 06200 - Finish Carpentry.
- F. Section 07620 - Sheet Metal Flashing and Trim.
- G. Section 08111 - Standard Steel Doors.
- H. Section 08112 - Standard Steel Frames.
- I. Section 08331 - Overhead Coiling Doors.
- J. Section 08675 - Steel Sliding Fire Windows.
- K. Section 09260 - Gypsum Board Assemblies.
- L. Section 09290 - Glass Fiber Reinforced Units.
- M. Division 15 - Mechanical: Painted identification.
- N. Division 16 - Electrical: Painted identification.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2012.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

1.04 DEFINITIONS

- A. Conform to ASTM D 16 for interpretation of terms used in this section.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on all finishing products, including VOC content.
- C. Samples: Submit two painted samples, illustrating selected colors for each color and system selected with specified coats cascaded. Submit on aluminum sheet, 6 x 6 inch in size.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame and smoke rating requirements for products and finishes.

1.08 MOCK-UP

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 8 feet long by 8 feet wide, illustrating specified coating color, texture, and finish.
- C. Provide door and frame assembly illustrating paint coating color, texture, and finish.
- D. Locate where directed.
- E. Mock-up may remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.11 EXTRA MATERIALS

- A. See Section 016000 - Product Requirements, for additional provisions.
- B. Supply 1 gallon of each color; store where directed.
- C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
 - i) Sherwin-Williams is the basis of design. Up to 8 colors to be selected by architect.
- B. Approved Manufacturers:
 - i) Benjamin Moore
 - ii) Behr
 - iii) PPG
 - iv) Kelly-Moore
- C. Primer Sealers: Same manufacturer as top coats.
- D. Block Fillers: Same manufacturer as top coats.

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Volatile Organic Compound (VOC) Content:
 - 1. Provide coatings that comply with the most stringent requirements specified in the following:

- a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.03 PAINT SYSTEMS – EXTERIOR

- A. Wood: Unprimed, Latex, 3 Coat:
 1. One coat of SW B42W8041, Exterior Latex Wood Primer.
 2. Semi-gloss: Two coats of SW A89-Series, SuperPaint Exterior Satin.
- B. Drywall, Unprimed, Latex, 3 Coat:
 1. One coat of SW B51-450 Series, Multi-Purpose Interior/Exterior Latex Primer.
 2. Semi-gloss: Two coats of SW A89-Series, SuperPaint Exterior Satin.
- C. Masonry/Concrete, Opaque Paint System, Latex, 3 Coat:
 1. One coat of SW LX2W50, Loxon Concrete & Masonry Primer.
 2. Flat: Two coats of SW A89-Series, SuperPaint Exterior Satin.
- D. CMU, Opaque Waterproofing System, Latex, 3 Coat:
 1. One coat SW CF1W50, ConFlex Block Filler.
 2. Flat: Two coats of SW CF11W51 Series, ConFlex XL Elastomeric Smooth.
- E. Ferrous Metals, (doors, frames, & handrails), Primed, Latex, 2 Coat:
 1. Touch-up with SW B66-1300 Series, Pro-Cryl Universal Water Based Primer.
 2. Semi-gloss: Two coats of B53-1150 Series, WB Alkyd Urethane Enamel Semi-Gloss.
- F. Galvanized Metals, Latex, 3 Coat:
 1. One coat of SW B66-1300 Series, Pro-Cryl Universal Water Based Primer.
 2. Gloss: Two coats of SW B66-1661 Series, Pro Industrial DTM Acrylic Eg-Shel.
- G. Aluminum, Unprimed, Latex, 3 Coat:
 1. One coat of SW B66-1300 Series, Pro-Cryl Universal Water Based Primer.
 2. Semi-gloss: Two coats of SW B66-1661 Series, Pro Industrial DTM Acrylic Eg-Shel.
- H. Architectural PVC, Plastic, Fiberglass: Unprimed, Latex, 3 Coat:
 1. One coat of SW B51W1150, Extreme Bond Interior/Exterior Bonding Primer.
 2. Semi-gloss: Two coats of SW A89-Series, SuperPaint Exterior Satin.
- I. Traffic Marking Paint Latex, 2 Coat:
 1. Two Coats Setfast Low VOC Acrylic Traffic Marking Paint, TM Series; White Yellow, Red, or Black.

2.04 PAINT SYSTEMS – INTERIOR

- A. Gypsum Board/Plaster Ceilings, Latex Flat Finish, 3 Coat:
 1. One coat of B28W2600, ProMar 200 Zero VOC Interior Latex Primer.
 2. Flat: Two coats of B30-2600 Series, ProMar 200 Zero VOC Interior Latex Flat.
- B. Gypsum Board/Plaster Walls, Latex-Acrylic Semi-Gloss Finish, 3 Coat:
 1. One coat of B28W2600, ProMar 200 Zero VOC Interior Latex Primer.
 2. Semi-gloss: Two coats of B31-2600 Series, ProMar 200 Zero VOC Interior Latex Semi-Gloss.

Alternate for upgrade Scuff Resistant Semi-Gloss:

1. One coat of B28W2600, ProMar 200 Zero VOC Interior Latex Primer.
 2. Eggshell: Two coats of SW K46-1150 Series, Pre-Catalyzed Waterbased Semi-Gloss.
- C. Concrete/Masonry, Opaque, Latex, 3 Coat:
1. One coat of SW LX2W50, Loxon Concrete & Masonry Primer.
 2. Flat: Two coats of SW B3-2600 Series, ProMar 200 Zero VOC Interior Latex Semi-Gloss.
- D. Ferrous Metals (doors, frames, & handrails), Unprimed, Latex, 3 Coat:
1. One coat of SW B66-1300 Series, Pro-Cryl Universal Water Based Primer.
 2. Semi-gloss: Two coats of B53-1150 Series, WB Alkyd Urethane Enamel Semi-Gloss.
- E. Galvanized Metals, Latex, 3 Coat:
1. One coat of SW B66-1300 Series, Pro-Cryl Universal Water Based Primer.
 2. Semi-gloss: Two coats of B66-1661 Series, Pro Industrial DTM Acrylic Eg-Shel.
- F. Aluminum, Unprimed, Latex, 3 Coat:
1. One coat etching primer: SW B71Y1, DTM Wash Primer.
 2. Semi-gloss: Two coats of B66-1661 Series, Pro Industrial DTM Acrylic Eg-Shel.
- G. Concrete/Masonry, Epoxy Enamel, 3 Coat: (typically wet areas)
1. One coat of SW LX2W50, Loxon Concrete & Masonry Primer.
 2. Gloss: Two coats of SW B73V300 Series, Waterborne Catalyzed Epoxy Gloss.
- H. CMU, Pre-Catalyzed Epoxy Finish Semi-Gloss, Latex, 3 Coat:
1. One coat SW CF1W50, ConFlex Block Filler.
 2. Eg-shel: Two coats of SW K46-1150 Series, Pre-Catalyzed Waterbased Semi-Gloss.
- I. Wood, Opaque, Latex, 3 Coat:
1. One coat of SW B28W8111, Premium Wall & Wood Interior Latex Primer
 2. Semi-Gloss: Two coats of SW K46-1150 Series, Pre-Catalyzed Waterbased Semi-Gloss.
- J. Wood, Transparent, Varnish, Stain:
1. One coat of Minwax Performance Series Tintable Interior Stain 7150/7151.
 2. One coat Minwax Performance Fast-Dry, Sanding Sealer 81580.
 3. Satin: Two coats of Minwax Performance Series Fast-Dry Varnish 9150/9151 Series.
- K. Fabrics/Insulation Jackets, Latex, 3 Coat:
1. One coat of SW B66-310 Series, Pro-Cryl Universal Water Based Primer.
 2. Semi-gloss: Two coats of B66-1661 Series, Pro Industrial DTM Acrylic Eg-Shel.
- L. Metal Decking DryFall Finish, Latex Flat, 2 Coat:
1. Flat: Two coats of B42W181, Pro Industrial Waterborne Acrylic DryFall Flat.
(possible primer if rusting is present)
- M. Metal Decking DryFall Finish, Latex Eg-Shel, 2 Coat:
1. Eg-Shel: Two coats of B42W82, Pro Industrial Waterborne Acrylic DryFall Eg-Shel.
(possible primer if rusting is present)
- N. Epoxy Floor Coating, 3 Coat:
1. One coat of SW B70V8100, ArmorSeal 8100 Water Based Epoxy Floor Coating.
(reduce with one pint of water per gallon)
 2. Satin or Gloss: Two coats of B70-8100/8160 Series ArmorSeal 8100 Water Based Epoxy Floor Coating.

- O. Resinous / Industrial Coatings for Concrete Floors.
High Performance Flooring Coatings – Sherwin-Williams

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Plaster and Stucco: 12 percent.
 - 3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 5. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 6. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

- I. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- J. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.
- K. Concrete Floors and Traffic Surfaces to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- L. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- M. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- N. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- O. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- P. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- Q. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- R. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Division 15 and Division 16 for schedule of color coding of equipment, duct work, piping, and conduit.
- B. Paint shop-primed equipment, where indicated.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 SCHEDULE - SURFACES TO BE FINISHED

- A. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically noted.
 - 2. Fire rating labels, equipment serial number and capacity labels.
 - 3. Stainless steel items.
- B. Paint the surfaces described 1 coat.
- C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
 - 1. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
 - 2. Paint shop-primed items occurring in finished areas.
 - 3. Paint interior surfaces of air ducts and convactor and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 - 4. Paint dampers exposed behind louvers, grilles, and convactor and baseboard cabinets to match face panels.

END OF SECTION

SECTION 099600 - HIGH PERFORMANCE COMMERCIAL COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete masonry units (CMU)
 - 2. Gypboard
 - 3. Overhead Steel
- B. Scope
 - 1. If there is a discrepancy between this section and other sections related to painting, this section shall take precedence.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.

1.3 QUALITY ASSURANCE

- A. Mockups: Apply benchmark samples 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 specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional [5] percent, but not less than [1 gal. (3.8 L)] of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
 1. Sherwin-Williams
 2. Tnemec
 3. Dupont
- B. Bidders desiring to use coatings other than those specified shall submit their proposal in writing to the Architect at least ten (10) days prior to the bid opening. Requests for substitution shall include manufacturer's literature for each product giving the name, descriptive information, solids by volume, recommended dry film thickness and a list of five projects where each product has been used and rendered satisfactory service. No request for substitution shall be considered that would decrease film thickness, the number of coats applied or fail to meet the performance requirements outlined in Section 2.2. The coating contractor shall submit manufacturer's certified test reports showing that the substitute product(s) equal or exceed the performance of the specified products outlined in the painting schedule.

2.2 PERFORMANCE REQUIREMENTS

- A. Modified Alkyd (Interior Steel Primer)
 1. ASTM D 3359 Adhesion
Requirements: No less than a rating of 5.
 2. ASTM B 117 Salt Fog
Requirements- No cracking, blistering, rusting or delamination of film. No rust creepage at scribe after 500 hours.
 3. Exterior Exposure (45° Facing South, Kansas City, MO)
Requirements- No cracking, blistering, rusting or delamination of film after 4 years.
- B. Self-Crosslinking Acrylic (Interior Overhead Steel Finish Coat)
 1. ASTM D 4541 Adhesion to Concrete
Requirement: Minimum 400 psi
 2. ASTM D 3363 Hardness
Requirement: No less than a rating of 3H
 3. ASTM D 4585 Humidity
Requirement: No rusting, blistering, cracking or delamination after 2000 hours.
- C. Cementitious Acrylic Block Filler
 1. ASTM D 2246 Freeze Thaw
Requirement: No blistering, cracking, or loss of adhesion after 30 cycles.

2. Exterior Exposure Light Industrial Area
Requirement: No blistering, cracking or delamination of film after three years exposure.
3. ASTM D 3359 Adhesion
Requirement: No less than a rating of 5.
4. ASTM D 4585 Humidity
Requirement: No blistering, cracking or visible loss of integrity after 1500 hours

D. Waterborne Epoxy

1. ASTM D 2486 Scrubbability
Requirement: Passes after minimum of 8000 cycles
2. ASTM E84 Surface Burning & Flame Smoke Spread
Requirement: Class A.

E. Zinc-rich primer

1. Test Method: ASTM G 85 Prohesion
Requirement: No blistering, cracking, or delamination of film. No more than 1/64" rust creepage at the scribe after 15,000 hours.
2. Test Method: ASTM B 117 Salt Fog
Requirement: No blistering, cracking, or delamination of film. No more than 1% rusting on the surface and no more than 1/4" rust creepage at the scribe after 20,000 hours.

F. Epoxy Intermediate Coat

1. Test Method: ASTM G 85 Prohesion
Requirement: No blistering, cracking, or delamination of film. No more than 1/8" rust creepage at the scribe after 5,000 hours.
2. Test Method: ASTM B 117 Salt Fog
Requirement: No blistering, cracking, delamination or rusting on the plane and no rust creepage at the scribe after 10,000 hours (with zinc primer).

G. Fluoropolymer Finish Coat

1. Test Method: ASTM D 4587 QUV Exposure (UVA 340 bulbs, Cycle 4: 8 hours UV/4 hours condensation)
Requirement: No blistering, cracking, or chalking. No less than 60% gloss retention after 25,000 hours exposure.
2. Test method: ASTM D 4141C (EMMAQUA)
Requirement: No blistering, cracking, or chalking. No less than 95% gloss retention after 1250 MJ/m² exposure.
3. Volume Solids:
Requirement: No less than 60% volume solids

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 work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Plaster: 12 percent.
 - 5. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- C. 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.
- D. 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.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
- F. Ferrous Metal
 - 1. Interior Steel:
 - a. Shop: SSPC-SP3 Power Tool Clean
 - b. Field:
 - 1) Clean and dry.
 - 2) Feather-edge the remaining intact coatings with the failed areas to create a smooth transition.
 - 3) Spot power tool clean in accordance with SSPC-SP3

- G. CMU
 - 1. Allow new masonry to cure a minimum of 14 days.
 - 2. Remove mortar spatter and level protrusions.
- H. Gypboard
 - 1. Clean and dry.
 - 2. Sand joint compound and feather-edge.

3.3 PAINTING SCHEDULE

- A. Gypboard in Corridors
 - 1. Prime Coat: Tnemec Series 51-792 PVA Sealer 1.0-2.0 dry mils
 - 2. Intermediate Coat: Tnemec Series 1029 Enduraone 2.0-3.0 dry mils
 - 3. Topcoat: Tnemec Series 1029 Enduraone 2.0-3.0 dry mils
 - 4. Prime Coat: SW B28W2600 ProMar 200 Zero VOC Primer 1.0-2.0 dry mils
 - 5. Intermediate Coat: SW B66-1560 Series Pro Industrial Multi-Surface Acrylic Eg-Shel 1.5-2.3 dry mils
 - 6. Topcoat: SW B66-1560 Series Pro Industrial Multi-Surface Acrylic Eg-Shel 1.5-2.3 dry mils
- B. CMU Substrates:
 - 1. Prime Coat: Tnemec Series 130 Envirofill 60-80 sq. Ft/Gal
 - 2. Intermediate Coat: Tnemec Series 1029 Enduraone 2.0-3.0 dry mils
 - 3. Topcoat: Tnemec Series 1029 Enduraone 2.0-3.0 dry mils
 - 4. Prime Coat: SW B42W150 Pro Industrial Heavy Duty Block Filler 75-100 sq. Ft/Gal
 - 5. Intermediate Coat: SW B66-1560 Series Pro Industrial Multi-Surface Acrylic Eg-Shel 1.5-2.3 dry mils
 - 6. Topcoat: SW B66-1560 Series Pro Industrial Multi-Surface Acrylic Eg-Shel 1.5-2.3 dry mils
- C. Steel Substrates - Overhead Steel see drawings.
 - 1. Shop primer and field touch-up Coat: Tnemec Series 10-99W Primer 2.5-3.5 dry mils
 - 2. Topcoat: Tnemec Series 115 Unibond 3.0-4.0 dry mils
 - 3. Shop primer and field touch-up Coat: SW B66-1300 Series Pro Industrial Pro-Cryl Universal Primer 1.9-3.8 dry mils
 - 4. Topcoat: SW B66-1560 Series Pro Industrial Multi-Surface Acrylic Eg-Shel 1.5-2.3 dry mils
- D. Metal Decking: (See Drawings)
 - 1. Primer/Topcoat: Tnemec Series 115 Unibond 3.0-4.0 dry mils
 - 2. Primer/Topcoat: SW B66-1560 Series Pro Industrial Multi-Surface Acrylic Eg-Shel 1.5-2.3 dry mils

*Note: A test patch is required to verify adhesion to the primer.

SEE COLORS TO BE SELECTED IN SECTION 099000 PAINTING & COATING OR SELECTED FROM MANUFACTURES STANDARD COLOR CHARTS.

The High Performance Industrial coatings are different from the Commercial Coatings for conditioned spaces; High Moisture and Chemical Resistance

-For exposed structural steel Industrial Projects use the following systems:

For carbon steel: (Zinc / Epoxy / Urethane)

Surface prep: Commercial Blast per SSPC SP6 / NACE 3, profile 1.5-2.5 mils

1. Prime Coat: Sherwin-Williams Zinc Clad 4100, 3.0-5.0 mis DFT
2. Intermediate Coat: Sherwin-Williams Macropoxy 646FC, 4.0-6.0 mils DFT
3. Topcoat: Sherwin-Williams Acrolon Ultra, 2.0-3.0 mils DFT

For Galvanized Steel: (Epoxy / Urethane)

Surface Prep: Brush Off Blast for Galvanized Steel per SSPC-SP16, Profile 1 mil minimum

1. Prime Coat: Sherwin-Williams Macropoxy 646FC, 4.0-6.0 mils DFT
2. Topcoat: Sherwin-Williams Acrolon Ultra, 2.0-3.0 mils DFT

*The galvanized takes the place of the zinc coating.

END OF SECTION 09960

SECTION 101416 - PLAQUES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes plaques.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For plaques.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show plaque mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Plaque Schedule: Use same designations specified or indicated on Drawings or in a plaque or sign schedule.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCT

1.6 PERFORMANCE REQUIREMENTS

1.6 PLAQUES

- A. Cast Plaque: Plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. R. K. Ramos Signage Systems.
 - b. Gemini Incorporated.
 - c. Metal Arts; Division of L & H Mfg. Co.
 - d. Metallic Arts.
 2. Plaque Material: Cast bronze.
 3. Plaque Thickness: 0.50 inch.
 4. Size: 18" x 24"
 5. Finishes:
 - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 6. Background Texture: As selected by Architect from manufacturer's full range.
 7. Integrally Cast Border Style: Raised flat band.
 8. Mounting: Concealed studs.

1.7 MATERIALS

- A. Bronze Castings: Lead-free alloy.

1.8 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 4. Plaque Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque, unless otherwise indicated.

1.9 FABRICATION

- B. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
3. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
4. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

PART 3 - EXECUTION

1.9 INSTALLATION

- A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
 1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
 2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
 3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
- C. Remove temporary protective coverings and strippable films as plaques are installed.

END OF SECTION 101416

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Molded-plastic dimensional characters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least 1/4" = 1'-0".

C. Samples: For each exposed product and for each color and texture specified.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 DIMENSIONAL CHARACTERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:

1. Ace Sign Systems, Inc.
2. A.R.K. Ramos.
3. ASI Sign Systems, Inc.
4. Gemini Incorporated.

- B. Back-lit Cast Metal Characters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Gemini Incorporated; Halo Lit Dimensional Letters or comparable product by one of the following:
2. Material: 514 alloy aluminum
3. Profile: Rounded or flat, as selected by Architect.
4. Mounting: Combination stud through pad on all mounts.
5. Lighting: Backlit with manufacturer's standard LED lighting system.
6. Color: Manufacturer's standard integral color process, in color as selected by Architect from manufacturer's full range. Custom colors required.

- C. Back-lit Custom Cutout Characters: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles; and as follows: See drawing.

1. Character Material: .063 aluminum 3" deep.
2. Character Height: see drawings.
3. Thickness: 3"
4. Finishes: Shall be custom colors verify exact colors with architect.
5. Mounting Concealed offset studs.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Sign Mounting Fasteners:
 - a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

- B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
- C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 101419

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Room-identification signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples: For each exposed product and for each color and texture specified.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1. Actual Room Names and Room Numbers to be used will be marked-up on shop drawings by the Construction Administrator, during the review process.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 SIGNS

- A. Custom Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Illuminated Panel Sign: Interior and Backlighted construction with LED lighting including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from sign surfaces as needed to illuminate evenly.
 - a. Power: As indicated on electrical Drawings.
 - 2. Solid-Sheet Sign Acrylic sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph below and as follows:
 - a. Surface-Applied Graphics: Applied photo image.
 - b. Etched and Filled Graphics: Sign face etched or routed to receive enamel-paint infill.
 - c. Inset, Cutout Characters: Sign face routed to receive push-through acrylic graphics.
 - 3. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: Square cut.
 - b. Corner Condition in Elevation: Custom.
 - 4. Frame: Entire perimeter with continuous edge retainers.
 - a. Material: Aluminum.
 - b. Profile: Custom.
 - c. Corner Condition in Elevation: Custom.
 - d. Finish and Color: As selected by Architect from manufacturer's full range.
 - 5. Mounting: Projecting from wall with concealed anchors.
 - 6. Surface Finish and Applied Graphics:
 - a. Photo-Image Graphics: Manufacturer's standard multicolor, 600-dpi halftone or dot-screen image.
 - b. Overcoat: Manufacturer's standard.
- B. Room-Identification Sign (Provide at each entry door to all rooms:
 - 1. Basis-of-Design Product: 2/90 Sign Systems; Slide Modular Sign System or equal.

2. Mounting: Manufacturer's standard method for substrates indicated.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 4. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
 - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
 - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Adhesives: As recommended by sign manufacturer and that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods (as applicable):

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
 3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 4. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
- C. Remove temporary protective coverings and strippable films as signs are installed.

SECTION 102113 – COLOR-THRU TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
 - 1. Electrolytically Zinc Coated: ASTM A 879/A 879M, 01Z (03G).
 - 2. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvanized.
- B. Zamac: ASTM B 86, commercial zinc-alloy die castings.
- C. Plastic Laminate: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.

2.2 PHENOLIC-CORE COLOR-THRU UNITS

- A. Basis Of Design: Subject to compliance with requirements, provide ASI Accurate Partitions, Color-Thru Phenolic, Warranty 25 years or comparable products by one of the following.
 - 1. **ASI Accurate Partitions**
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. Bradley Corporation; Mills Partitions.
- B. Toilet-Enclosure Style: Floor Anchored Overhead Braced
- C. Urinal-Screen Style: Wall mount.
- D. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with laminated plastic facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch-thick doors and pilasters and minimum 3/4-inch thick panels. NO panels shall be less than 3/4" thick including panels that are between compartments.
- E. Pilaster Shoes and Sleeves (Caps): Fabricated from stainless-steel sheet, not less than 3 inches high, finished to match hardware.
- F. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters with shoe and sleeve (cap) matching that on the pilaster.
- G. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.
- H. Phenolic-Panel Finish: Color-Thru
 - 1. Color and Pattern: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

- A. Hardware and Accessories: Shall be ASI Accurate, gravity cam-action hinge that permits door to return to a pre-set position when not locked. Hinge, strike/keeper and slide latch shall be brushed finish to resist corrosion and thru-bolted with tamper resistant barrel nuts and shoulder screws. Cam-action hinge shall allow emergency access by lifting the door from the bottom.
 - 1. Material: Stainless steel.
 - 2. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors and entrance-screen doors.
 - 3. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard clear anodized finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.
- D. Warranty: ASI Accurate Partitions guarantees its phenolic partitions against delamination, breakage or corrosion for 25 YEARS from the date of substantial completion. If material is found defective during that period, the material shall be replaced free of charge. No credits or allowances shall be issued for any labor or expenses relating to the replacement of components covered under the warranty plan.

2.4 FABRICATION

- A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at[tops and] bottoms of posts. Provide shoes[and sleeves (caps)] at posts to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch wide, in-swinging doors for standard toilet compartments and 36-inch wide, out-swinging doors with a minimum 32-inch wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
- B. Clearances: Maximum 1/2 inch between pilasters and panels; 1 inch between panels and walls.
- C. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors[and doors in entrance screens] to return doors to fully closed position.

END OF SECTION 102113

102600 – STAINLESS STEEL CORNER GUARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Corner guard system for wall protection:

1.02 SECTION INCLUDES

- A. Surface Mounted, Stainless Steel Corner Guard Systems

1.03 SUBMITTALS

- A. Product data for each type of corner guard specified.
- B. Detail drawings indicating mounting details with the appropriate fasteners for specific project substrates.
- C. Samples for verification purposes of corner guard, 6" (152mm) long, in full size profiles of each type and color indicated.
- D. Cleaning and maintenance instructions for door and wall protection systems.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in unopened factory packaging to the jobsite and store in original packaging in a climate controlled location away from direct sunlight.

1.05 PROJECT CONDITIONS

- A. Products must be installed in an interior climate controlled environment.

1.06 WARRANTY

- A. Standard Koroseal Limited Lifetime Warranty against material and manufacturing defects.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Basis Of Design: Subject to compliance with requirements, provide Koroseal Wall Protection Systems, Louisville, KY. Ph: 855-753-5474; Fax: 330-668- 7703; Internet Address: www.korogard.com or comparable products by one of the following.
 - 1. Construction Specialties
 - 2. IPC Door and Wall Protection Systems, InPro Corporation American
 - 3. Floor Products Company, Inc.

- B. Provide all corner guards and wall protection from a single source.

2.02 MANUFACTURED UNITS

A. Corner Guards

1. Surface-Mounted, Stainless Steel Corner Guards: Model, Size, Attachment Method, Grade, Thickness
 - a. Cover: stainless steel, nominal 0.078 inch (1.9 mm) thick, in dimensions and profiles indicated.
 - b. Retainer:
 - i. Continuous, one-piece, extruded aluminum retainer, nominal 0.062 inch (1.6 mm) thick.
 - c. GS20 Series: 2 inch (50.8 mm).
 - d. Finish: As selected.

2.03 MATERIALS

1. Stainless Steel Material: Extruded, textured, chemical-and stain-resistant, high-impact, stainless steel, thickness as indicated. Comply with specified requirements of ASTM D 256 for impact resistance and ASTM E 84 for flame spread and smoke developed characteristics. Color: As selected by Architect from the manufacturer's full range of standard colors.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M) for 6063-T5
3. Fasteners: Use non-corrosive metal screws, bolts, and other fasteners compatible with aluminum components, hardware, anchors, and other items being fastened. Use theft-proof fasteners where exposed to view.

2.04 COMPONENTS

A. Attachment

1. Adhesive: Field applied heavy duty adhesive
2. Fasteners: Pre-drilled beveled holes and Phillips head screws.

2.05 FINISHES

- A. Stainless Steel: Finish to be selected by architect from full range of manufacturer selections.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions in which the corner guard systems will be installed.
1. Complete all finishing operations, including painting, before beginning installation of corner guards.

- B. Wall surface shall be dry and free from dirt, grease, and loose paint.

3.02 PREPARATION

- A. General: Prior to installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION

1. General: Locate the corner guard as indicated on the approved detail drawing for the appropriate substrate and in compliance with the Koroseal installation instructions. Install corner guard level and plumb at 8'-0" tall.
2. Installation of Corner Guards:
 - a. Install wall surface protection units plumb, level, and true to line without distortions.
 - b. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.
 - c. Install aluminum retainers, mounting brackets, and other accessories in strict accordance with the manufacturer's instructions.
 - d. Where splices occur in horizontal runs of over 20 feet (6 m), splice aluminum retainer at same locations along the run.

3.04 CLEANING

1. Clean metal components in accordance with the manufacturer's recommendations.
2. Remove excess adhesive in manner recommended by manufacturer.

END OF SECTION

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Under-lavatory guards.
3. Custodial accessories.
4. Hand dryers

B. Owner-Furnished Material.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. American Specialties, Inc. (ASI)
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
- B. Grab Bar:
 1. Basis-of-Design Product: ASI 164 Satin Finish.
 2. Mounting: Flanges with concealed fasteners.
 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 4. Outside Diameter: 1-1/2 inches.
 5. Configuration and Length: As indicated on Drawings.
- C. Mirror Unit:
 1. Basis-of-Design Product: ASI #0600 B1836 Tempered Glass Welder-Frame mirror.
 2. Frame: Stainless-steel angle, 3/4" inch thick.
 - a. Corners: Welded and ground smooth.
 3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 4. Size: 18x36
- D. Soap Dispenser: BY OWNER
- E. Toilet Tissue Dispenser: BY OWNER

2.2 WARM-AIR DRYERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
 4. World Dryer Corporation.
- B. Warm-Air Dryer:
1. Basis-of-Design Product: ASI Model #0135 Turbo-Tuff Recess Mounted Sensor Hand Dryer.
 2. Mounting: Recess mounted.
 3. Operation: Electronic-sensor activated with timed power cut-off switch.
 4. Electrical Requirements: 110-120 V, 10.4 Amps.
 5. Finish: Brushed
 6. Stainless steel, No. 4 finish (satin).

2.3 UNDER-LAVATORY GUARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Plumberex Specialty Products, Inc.
 2. Truebro by IPS Corporation.
- B. Under-lavatory Guard:
1. Basis-of-Design Product: Truebro LA Guard 2.
 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 3. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CUSTODIAL ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
- B. Mop and Broom Holder:
1. Basis-of-Design Product: ASI 0796-3 Mop Rack Surface mounted.

2. Description: Unit with 3 serrated rubber cam for grasping.
3. Length: 26 inches
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: 20 Ga. Type 304 Stainless steel, No. 4 finish (satin). Projects 1/2" from wall.

2.5 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fire-protection cabinets for portable fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fire-protection cabinets.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 FIRE-PROTECTION CABINET

- A. Basis-of-Design Product : Subject to compliance with requirements, provide JL Industries, Inc.; 1537 "Clear VU FX2" or comparable product by one of the following:
 - 1. Larsen's Manufacturing
 - 2. Guardian Fire Equipment, Inc.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 3 inch backbend depth.

- E. Cabinet Trim Material: Stainless-steel sheet.
- F. Door Material: Stainless-steel sheet.
- G. Door Style: Full acrylic bubble with frame.
- H. Door Glazing: Molded acrylic bubble.
 - 1. Acrylic Bubble Color: Clear, transparent.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- J. Accessories:
 - 1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Diecut vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- K. Materials:
 - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: White.
 - 2. Stainless Steel: ASTM A 666, Type 304.
 - a. Finish: No. 4 directional satin finish.

2.2 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.
- B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- D. Identification: Apply vinyl lettering at locations indicated.
- E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide JL Industries, Inc.; Cosmic 10E or comparable product by one of the following:
 - a. Ansul Incorporated.
 - b. Guardian Fire Equipment, Inc.
 - c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - d. Larsens Manufacturing Company.
 - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

2.3 MOUNTING BRACKETS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide JL Industries, Inc.; MB846A or comparable product by one of the following:
 - 1. Ansul Incorporated.
 - 2. Guardian Fire Equipment, Inc.
 - 3. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - 4. Larsens Manufacturing Company.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 48 inches above finished floor to top of fire extinguisher.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 10 7326 – EXTRUDED PROTECTIVE COVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pre-engineered, pre-finished extruded aluminum walkway covers.
- B. Pre-engineered, pre-finished extruded aluminum canopies over doors

1.2 RELATED SECTIONS

- A. Section 03100 - Concrete Forms and Accessories.
- B. Section 03300 - Cast-In-Place Concrete.

1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 603 - Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
 - 2. AAMA 605 - Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 3. AAMA 607.1 - Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
 - 4. AAMA 608.1 - Voluntary Guide Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.

1.4 DESIGN REQUIREMENTS

- A. Columns, Beams, Deck, and Trim: Aluminum extrusions.
- B. Structural Framing: Interlocking deck sections secured by screws.
 - 1. Heli-arc welded, one-piece rigid bents.
 - 2. Mechanically fastened bents using internally concealed bolted connections.
- C. Canopy: Self-draining from deck through bents to discharge point at ground level or as otherwise shown.
- D. Building Code: IBC 2021.
- E. Design Loads:
 - 1. Comply with Building Code for site location.
 - 2. Collateral Loads: Additional loads imposed by other materials or systems identified in contract documents.
- F. Structural Design: Prepare complete structural design calculations for canopy members including footings.

- G. Structural Design: Prepare complete structural design calculations for canopy members except footings. Provide reactions as required for footing design by a registered professional engineer.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's catalog data, detail sheets, and specifications.
- C. Shop Drawings: Layout and erection drawings showing roof framing, deck panels, cross sections, and trim details, clearly indicating proper assembly.
- D. Samples: Color selection samples consisting of actual coating material or anodizing process on aluminum extrusions.
- E. Quality Assurance/Control Submittals:
 - 1. Qualifications: Letter certifying manufacturer's required qualifications.
 - 2. Structural Design Calculations.
 - 3. Manufacturer's Installation Instructions.

1.6 QUALITY ASSURANCE

- A. Overall Standard: Structural engineering design documents stamped by a structural engineer registered to practice in the state of **Louisiana**.
- B. Manufacturer Qualifications: Minimum five years' experience in producing covers/canopies with welded bents and of the type specified.
- C. Installer Qualifications: Minimum of two years' experience in erecting covers/canopies of the type specified.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Conform to Section 01660 - Product Storage and Handling Requirements.
- B. Follow manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design : Furnish and install Perfection Architectural Systems, Inc., 2310 Mercator Drive Orlando, FL 32807; ASD. Tel: (800) 238-7207, Fax: (407) 671-8252. or by one of the following.
 - 1. Ballew's Aluminum Products, Inc. 1.800.231.6666
 - 2. Peachtree Protective Covers 800.341.3325

- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.
- C. Provide all protective covers from a single manufacturer.

2.2 MATERIALS

- A. Aluminum Extrusions: 6063 alloy, T-6 temper.
- B. Grout: 1 part portland cement, 3 parts masonry sand; 2,000 pounds per square inch (13.8 MPa) compressive strength.
- C. Foam Block-Outs: Rigid foam blocks sized as required for column embedment depth and shape.

2.3 COMPONENTS

- A. Columns:
 - 1. Radius-cornered aluminum tubular extrusion as required by structural engineering design.
 - 2. Grout Key: Provide two 1-1/2-inch (38 mm) diameter holes in column base, one each in opposite sides.
 - 3. Provide clear acrylic protection coat on surfaces in contact with grout.
- B. Beams: Open top aluminum tubular extrusions.
 - 1. Size: As required by structural engineering design.
- C. Deck: Rigid-Roll-Lock extruded aluminum, self-flashing, interlocking sections.
 - 1. Size and Profile: As required by structural engineering design.
 - 2. Provide welded endplate water dams where sections terminate at other than drainage channels.
- D. Fascia: Manufacturer's standard extruded aluminum fascia sections as shown on drawings and as required to complete the installation resulting in a neat finished appearance.
 - 1. Include manufacturer's standard extruded aluminum gutters.
- E. Flashing: Aluminum sheet, thickness as recommended by manufacturer for specific condition.

2.4 ACCESSORIES

- A. Fasteners:
 - 1. Deck Screws: No. 14 by 1 inch (25 mm), self-tapping, Type 18-8 stainless steel with neoprene washers.
 - 2. Trim Screws: No. 10 by 1/2 inch (13 mm), self-tapping, Type 18-8 stainless steel.
 - 3. Trim Rivets: Aluminum, size recommended by manufacturer for specific condition.
 - 4. Other Fasteners: Type 18-8 stainless steel, type recommended by manufacturer for specific condition.

2.5 FABRICATION

- A. Shop Assembly: Fabricate cross beams and columns into one-piece rigid bents with corners mitered and heli-arc welded to the extent that completed bents can be shipped on local, state, and federal highways without special permit. Provide bolted connections for bents required to be shipped unassembled.
- B. Shop Assembly: Fabricate cross beams and columns for field assembled bolted connections.

2.6 FINISHES

- A. Bents:
 - 1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA-C-12C-42R-1, standard color as selected by architect, comply with AAMA 605.
 - a. Two coat application color to match existing .
- B. Deck:
 - 1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA-C-12C-42R-1, custom color as selected by architect, comply with AAMA 605.
 - a. Two coat application color to match existing.
- C. Fascia/Gutter:
 - 1. Fluoropolymer Coating: 70 percent PVDF resin-based fluoropolymer, AA-C-12C-42R-1, custom color as selected by architect, comply with AAMA 605.
 - a. Two coat application color to match existing.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine footings in which bents will be set. Verify footing locations and elevations comply with shop drawings.
- B. Examine building surfaces to which canopy will connect.
- C. Coordinate with responsible trade to perform corrective work on unsatisfactory footings or surfaces.
- D. Commencement of work by installer is acceptance of existing conditions.

3.2 ERECTION

- A. Erect protective covers in accordance with manufacturer's installation instructions.
- B. Set bents plumb, straight, and true to line, adequately braced to maintain position until grout has cured.

- C. Keep aluminum surfaces from direct contact with ferrous metal or other incompatible materials by applying one coat of zinc chromate primer; follow with two coats of aluminum paint.
 - 1. In lieu of aluminum paint, one coat of high-build bituminous paint applied to 1/16 inch (1.6 mm) thickness may be used.

3.3 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

3.4 PROTECTION

- A. Protect finished aluminum surfaces from damage due to subsequent construction operations.

END OF SECTION

SECTION 123661 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-surface-material countertops, bench tops and backsplashes.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures. For bench tops. Show materials, finishes, edge profiles, methods of joining, and cutouts.

C. Samples: For each type of material exposed to view.

1.3 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of simulated stone countertop systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace simulated stone materials that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Basis Of Design: Provide countertops with the following front and backsplash style. Solid Surface Countertop shall be **Wilsonart Iron Falls**

1. Front: 3/4-inch.
2. Backsplash: Straight, slightly eased at corner.
3. Endsplash: Matching backsplash.

- B. Countertops: 3/4-inch thick, solid surface material with front edge built up with same material
- C. Backsplashes: 3/4-inch thick, solid surface material.

2.2 SOLID-SURFACE-MATERIAL BENCH TOPS

- A. Basis Of Design: Provide bench tops with the following style. Solid Surface Countertop shall be **Wilsonart Iron Falls**
 - 1. Front: 3/4-inch.
- B. Bench tops: 3/4-inch thick, solid surface material with front edge built up with same material

2.3 COUNTERTOP MATERIALS

- A. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- C. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
 - 1. Manufacturers: Subject to compliance with requirements, provide products indicated by the drawings or comparable products by one of the following:
 - a. Avonite Surfaces.
 - b. Dupont Co.
 - c. Formica Corporation.
 - d. Wilsonart International.
 - 2. Type: Provide Standard Type or Veneer Type made from material complying with requirements for Standard Type, as indicated unless Special Purpose Type is indicated.
 - 3. Colors and Patterns: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

END OF SECTION 123661

SECTION 211300 - FIRE PROTECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following fire-suppression piping inside the building:
 - 1. Wet-pipe sprinkler systems.
 - 2. Fire department connection.

1.3 SYSTEM DESCRIPTIONS

- A. Wet Pipe Sprinkler System: Automatic sprinklers are attached to piping and that is connected to water supply. Water discharges from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.

1.4 PERFORMANCE REQUIREMENTS

- A. Fire-suppression, wet-pipe sprinkler systems design shall be approved by authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Piping materials, including sprinkler specialty fittings.
 - 2. Pipe hangers and supports.
 - 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
 - 4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 - 5. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
 - 6. Alarm devices, including electrical data.
- B. Shop Drawings: Diagram power, signal, and control wiring.

- C. Fire-hydrant flow test report.
- D. Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13 and others as applicable, including hydraulic design calculations, shall be submitted to the Architect/Engineer for review and comments. The corrected drawings shall then be submitted to the State Fire Marshall and Property Insurance Association for approval as applicable. Submit five copies of all drawings, stamped as approved by these agencies, to the Architect.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- F. Welding certificates.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
- B. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems".
 - 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
 - 3. Property Insurance Association
 - 4. City of Monroe Fire Prevention Bureau

1.7 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

2.1 SYSTEM PIPING AND FITTINGS

- A. Piping shall be standard weight wrought steel pipe. Fitting shall be cast iron. Pipe and fittings shall be UL listed for use in sprinkler work.

2.2 PIPING SYSTEM VALVES

- A. Valves shall be approved for fire protection piping systems and shall be installed as required by NFPA.

2.3 AUTOMATIC SPRINKLER HEADS

- A. Shall be upright, concealed sidewall or concealed pendent, as specified or noted, of the proper temperature rating, and installed throughout the areas as required by the insurance authority.

2.4 SPRINKLER RISER

- A. Shall be equipped with a variable pressure alarm valve including retarding chamber, drain valve, and standard trimming and gauges.

2.5 WATER MOTOR GONGS

- A. Shall be furnished for alarm valve and located as required.

2.6 FIRE DEPARTMENT CONNECTIONS

- A. Shall be a remote two-way, 2 1/2" x 2 1/2" x 6" Siamese wye connections labeled appropriately as "AUTOMATIC SPRINKLER". Connections shall be chrome plated and polished.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 EARTHWORK

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.3 EXAMINATION

- A. Examine roughing-in for hose connections to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thicknesses, fire-rated construction and other conditions where hose connections are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS, GENERAL

- A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- B. Underground Service-Entrance Piping: Ductile-iron, mechanical-joint pipe and fittings and restrained joints. Include corrosion-protective encasement.

3.5 VALVE APPLICATIONS

- A. Drawings shall indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.
 - a. Shutoff Duty: Use ball, butterfly, or gate valves.
 - b. Throttling Duty: Use ball or globe valves.

3.6 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
 - 1. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
 - 2. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
 - 3. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
 - 4. NPS 2-1/2 to NPS 4: Use dielectric flanges.
 - 5. NPS 5 and Larger: Use dielectric flange insulation kits.

3.7 SERVICE-ENTRANCE PIPING

- A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories required at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.8 WATER-SUPPLY CONNECTION

- A. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories required at connection to water distribution piping.
- B. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.9 PIPING INSTALLATION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical. Coordinate with other trades.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13. Coordinate exact location with Owner and Architect to avoid installation in publicly visible location. Indicate in shop drawing submittal.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- J. Install alarm devices in piping systems.
- K. Hangers and Supports: Comply with NFPA 13 for hanger materials.
 1. Install sprinkler system piping according to NFPA 13.
- L. Install pressure gages on riser or feed main, at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Fill wet-pipe sprinkler system piping with water.

3.10 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

C. Specialty Valves:

1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.11 SPRINKLER APPLICATIONS

A. Drawings shall indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:

1. Rooms without ceilings: Upright sprinklers.
2. Rooms with suspended and rigid ceilings: Concealed pendent sprinklers.
3. Wall mounting: Sidewall concealed pendent sprinklers.
4. Sprinkler finishes:
 - a. Upright, concealed pendent and sidewall sprinklers: White-baked enamel, with white-baked enamel escutcheon and cover plate (as applicable) in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.

3.12 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.13 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire department connections in vertical wall.
- B. Install ball drip valve at each check valve for fire department connection.

3.14 FREEZE PROTECTION

- A. The contractor shall be responsible for freeze protection of piping and sprinkler heads in unheated areas.

3.15 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

- C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping.
- D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- E. Connect piping to specialty valves, hose valves, specialties, fire department connections and accessories.
- F. Electrical Connections: Power wiring is specified in Division 26.
- G. Connect alarm devices to fire alarm as applicable.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding."
- I. Connect wiring according to Division 26 Section "Conductors and Cables."
- J. 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.

3.16 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.17 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Energize circuits to electrical equipment and devices.
 - 4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 5. Coordinate with fire alarm tests. Operate as required.
 - 6. Verify that equipment hose threads are same as local fire department equipment.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.18 CLEANING AND PROTECTION

- A. Clean dirt and debris from sprinklers.

- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until substantial completion.

3.19 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

END OF SECTION 211300

SECTION 220523 – VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes general-duty valves.

1.3 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

- A. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- B. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- E. Valve Actuators:
 1. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
 2. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
- F. Extended Valve Stems: On insulated valves.
- G. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- H. Valve Grooved Ends: AWWA C606.
- I. Valve Bypass and Drain Connections: MSS SP-45.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

- C. Operate valves in positions from fully open to fully-closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, gate, or plug valves.
 - 2. Throttling Service: Angle, ball, butterfly or globe valves.
 - 3. Pump Discharge: Swing check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement. End chains to 60 inches above finished floor elevation.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 220523

SECTION 220700 - PIPE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 23 Section "Duct Insulation" for insulation for ducts and plenums.
 - 2. Division 23 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping installer for insulation application.

1.7 SCHEDULING

- A. Schedule insulation application after testing piping systems. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - d. Schuller International, Inc.
 - 2. Cellular-Glass Insulation:
 - a. Pittsburgh-Corning Corp.
 - 3. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.
 - 4. Closed-Cell Phenolic-Foam Insulation:
 - a. Kooltherm Insulation Products, Ltd.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
 2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
 3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
 4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
 5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
 6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
 7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- B. Cellular-Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class 1.
 2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.
- C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
1. Adhesive: As recommended by insulation material manufacturer.
 2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
- D. Closed-Cell Phenolic-Foam Insulation: Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
- E. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

- C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. PVC Jacket Color: White or gray.
 - 3. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.
- D. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultraviolet-resistant PVC.
 - 1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
 - 2. Adhesive: As recommended by insulation material manufacturer.
- E. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, pre-sized a minimum of 8 oz./sq. yd..
 - 1. Tape Width: 4 inches.
- B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
 - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
 - 2. Galvanized Steel: 0.005 inch thick.
 - 3. Aluminum: 0.007 inch thick.
 - 4. Brass: 0.010 inch thick.
 - 5. Nickel-Copper Alloy: 0.005 inch thick.
- C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches O.C.
 - 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches O.C.
 - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
 - 4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
 - 5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- P. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Fire-stopping and fire-resistive joint sealers are specified in Division 7 Section "Fire-stopping."

- S. Floor Penetrations: Apply insulation continuously through floor assembly.
 - 1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

- 1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
- 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
- 3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches O.C.
- 4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

- 1. Apply preformed pipe insulation to outer diameter of pipe flange.
- 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
- 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
- 4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

- 1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
- 2. When pre-molded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
- 3. Cover fittings with standard PVC fitting covers.
- 4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

- 1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
- 2. When pre-molded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow

- valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
 4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
 5. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
 6. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 CELLULAR-GLASS INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches O.C.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of the same thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded sections of insulation are not available, apply mitered sections of cellular-glass insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply pre-molded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
2. Apply insulation to flanges as specified for flange insulation application.
3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.6 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.
3. Apply insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.7 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches O.C.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same material and thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When pre-molded sections of insulation are not available, apply mitered segments of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.

4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
6. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.8 FIELD-APPLIED JACKET APPLICATION

- A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
 1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
 3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.
- B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.
 1. Draw jacket material smooth and tight.
 2. Apply lap or joint strips with the same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Apply jackets with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.
- C. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
- D. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches O.C. and at end joints.

3.9 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.10 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Flexible connectors.
 - 2. Vibration-control devices.
 - 3. Fire-suppression piping.
 - 4. Drainage piping located in crawl spaces, unless otherwise indicated.
 - 5. Below-grade piping, unless otherwise indicated.
 - 6. Chrome-plated pipes and fittings, unless potential for personnel injury.
 - 7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.11 FIELD QUALITY CONTROL

- A. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
 - 1. Inspect fittings and valves randomly selected by Architect.
 - 2. Remove fitting covers from 20 elbows or 1 percent of elbows, whichever is less, for various pipe sizes.
 - 3. Remove fitting covers from 20 valves or 1 percent of valves, whichever is less, for various pipe sizes.
- B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.12 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.13 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Domestic hot water.
 - 1. Operating Temperature: 60 to 140 deg F.
 - 2. Insulation Material: Fiberglass, with jacket.

3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper Pipe: 1" thick
 4. Field-Applied Jacket: Foil and paper.
 5. Vapor Retarder Required: Yes.
 6. Finish: Painted.
- B. Service: Condensate drain piping.
1. Operating Temperature: 35 to 75 deg F.
 2. Insulation Material: Flexible elastomeric.
 3. Insulation Thickness: 0.5 inch.
 4. Field-Applied Jacket: None.
 5. Vapor Retarder Required: Yes.
 6. Finish: None.
- C. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.
1. Operating Temperature: 35 to 120 deg F.
 2. Insulation Material: Flexible elastomeric.
 3. Insulation Thickness: 0.75 inch.
 4. Field-Applied Jacket: PVC P-trap and supply covers.
 5. Vapor Retarder Required: No.
 6. Finish: None.
- D. Service: Refrigerant suction and hot-gas piping.
1. Operating Temperature: 35 to 50 deg F.
 2. Insulation Material: Flexible elastomeric.
 3. Insulation Thickness: 0.75 inch.
 4. Field-Applied Jacket: None, interior; exterior as noted/specified.
 5. Vapor Retarder Required: No.
 6. Finish: No.
- E. Service: Domestic cold water.
1. Operating temperature: 45 to 80 deg F.
 2. Insulation material: Mineral fiber.
 3. Insulation thickness: 0.5 inch.
 4. Field-Applied Jacket: ASJ.
 5. Vapor retarder required: Yes.
 6. Finish: None.
- F. Service: Waste from floor and hub drains: Same as domestic cold water.
- G. Service: Underside of roof drains.
1. Operating temperature: 45 to 80 deg F.

2. Insulation material: Mineral fiber.
3. Insulation thickness: 0.5 inch.
4. Jacket: ASJ.
5. Vapor retarder required: Yes.
6. Finish: None.

H. Service: Roof drain piping: 2" thick, $\frac{3}{4}$ pound density fiberglass duct wrap.

3.14 EXTERIOR INSULATION APPLICATION

- A. All insulation outside, exposed to weather shall be covered with aluminum metal jacket. At joints, fittings, etc. only, a white elastomeric coating may be used.

END OF SECTION 220700

SECTION 221100 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Domestic Water Service Piping: 160 psig.
 - 2. Domestic Water Distribution Piping: 125 psig.

1.4 SUBMITTALS

- A. Product Data: Required where indicated only. Submittal of pipe and fittings not required unless a change from specification is proposed.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances," and NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for combined fire-protection and domestic water service piping to building.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- D. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 DUCTILE-IRON PIPING

- A. Piping for fire-suppression applications shall be listed for fire-protection service.
- B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end, unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron, standard pattern; or AWWA C153, ductile-iron, compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 - 2. Ductile-Iron Piping, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.
 - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606 for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end, unless grooved or flanged ends are indicated.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron, standard pattern; or AWWA C153, ductile-iron, compact pattern.
 - a. Gaskets: AWWA C111, rubber.
 - 2. Ductile-Iron, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.
 - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

3. Ductile-Iron, Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed, ball-joint sections and one or more gasketed, sleeve section. Assemble components for offset and expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
4. Ductile-Iron, Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
5. Ductile-Iron, Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.

2.3 COPPER TUBING

A. Soft Copper Tube: ASTM B 88, Types L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
 - a. Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.4 PE ENCASUREMENT

- ### A. PE Encasement for Underground Metal Piping: ASTM A674 or AWWA C105 PE film, 0.008-inch minimum thickness, tube or sheet.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.
- D. Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.
- E. Underground Domestic Water Piping: Use any of the following piping materials for each size range:
 - 1. NPS 3-1/2 and smaller: PVC piping or soft copper tube, Type L copper pressure fittings; and soldered joints. Exterior to the building and outside of any concrete flatwork.
 - 2. NPS 2 to NPS 4: Hard copper tube, Type L; wrought copper pressure fittings; and silver-fos soldered joints. Under the building slab and beneath any concrete flatwork.
 - 3. NPS 1-1/2 and Smaller: Soft copper tube, Type L; Pipe joints to be avoided and permitted only to the extent of run lengths exceeding that of a single roll length of tubing. Should joints be required use wrought copper pressure fittings and silver-fos soldered joints. Under the building slab or any other concrete flatwork.
- F. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
 - 1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.

3.2 VALVE APPLICATIONS

- A. Submittal required. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Drain Duty: Hose-end drain valves.
- B. Cast-iron, grooved-end valves may be used with grooved-end piping.

3.3 PIPING INSTALLATION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.

- B. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.
- C. Install underground ductile-iron piping according to AWWA C600, AWWA M41, and NFPA 24. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 - 1. Encase piping with polyethylene film according to ASTM A 674 or AWWA C105.
- D. Install underground copper tubing according to CDA's "Copper Tube Handbook."
- E. Install underground AWWA PVC piping according to NFPA 24, AWWA M23, and ASTM F 645. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
- F. Install underground PVC piping according to ASTM D 2774 and ASTM F 645. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
- G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- H. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for wall penetration systems.
- I. Install aboveground domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- J. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
- K. Perform the following steps before operation:
 - 1. Close drain valves and hydrants.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 - 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

- L. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- D. Mechanically Formed Outlets: Form tee in copper tube according to equipment manufacturer's written instructions. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.5 VALVE INSTALLATION

- A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 23 Section "Hangers and Supports" for pipe hanger and support devices.
- B. Install supports according to Division 23 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2-1/2: 96 inches with 3/8-inch rod.
- F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:
 - 1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
 - 3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 8 hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221100

SECTION 221119 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following plumbing specialties:

1. Roof flashing assemblies.
2. Key-operation hydrants.
3. Roof drains and downspout nozzles.
4. Miscellaneous piping specialties.
5. Cleanouts.
6. Floor drains.
7. Through-penetration fire-stop assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig.
2. Sanitary Waste and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Water hammer arresters and air vents.
2. Drain valves and hydrants.
3. Cleanouts and floor drains.

- B. Shop Drawings: Diagram power, signal, and control wiring.

- C. Field test reports.

- D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Hydrants.
2. Roof drains and downspout nozzles.

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- E. NSF Compliance:
 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-PW" on plastic potable-water piping and "NSF-DWV" on plastic drain, waste, and vent piping.
 2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

PART 2 PRODUCTS

2.1 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Acorn Engineering Company; Elmdor/Stoneman Div.
Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 1. Open-Top Vent Cap: Without cap.
 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.2 KEY-OPERATION HYDRANTS

- A. General: As scheduled, ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig.
- B. Inlet: NPS 3/4 or NPS 1 threaded or solder joint.
- C. Outlet: ASME B1.20.7, garden-hose threads.
- D. Operating Keys: One with each key-operation hydrant.

2.3 ROOF DRAINS

- A. Metal Roof Drains/Downspout Nozzles:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Jay R. Smith.
 - b. Josam.
 - c. Mifab.
 - d. Sioux Chief.
 - e. Wade.
 - f. Watts.
 - g. Zurn

2.4 MISCELLANEOUS PIPING SPECIALTIES

- A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.
- B. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting, joined with ASTM C 564, rubber gaskets.
- C. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.
 - 1. NPS 2: 4-inch- minimum water seal.
 - 2. NPS 2-1/2 and larger: 5-inch- minimum water seal.
- D. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

- E. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semi-open top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.
- F. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.5 CLEANOUTS

A. Cleanouts.

- 1. Application: Floor cleanout, Wall cleanout; for installation in exposed piping, and exterior cleanout.
- 2. Products:
 - a. Floor Cleanout in finished areas: Tyler Pipe, Wade Div.; #W-7000 w/ satin nickel bronze top.
 - b. Floor Cleanout in tile floors: Tyler Pipe, Wade Div.; #W-7000-T.
 - c. Floor Cleanout in terrazzo floors: Tyler Pipe, Wade Div.; #W-7000-U.
 - d. Floor Cleanout in unfinished utility or storage areas: Tyler Pipe, Wade Div.; #W-8550-D.
 - e. Wall Cleanout: Tyler Pipe, Wade Div.; #W-8450-R w/ stainless steel cover plate.
 - f. Cleanout in exposed piping: Tyler Pipe, Wade Div.; #W-8550-R.
 - g. Exterior Cleanout: Tyler Pipe, Wade Div.; #W-7040-X w/ nickel bronze top.
- 3. Cleanouts in waterproof floors shall have flashing flange and clamping device.
- 4. Cleanouts in carpeted areas shall be provided with carpet makers (Wade option No. 72).
- 5. Reference Section 224200 for additional alternate manufacturers.

2.6 FLOOR DRAINS

A. Floor Drains, Wade Div. #W-1100, shall be provided as indicated on drawings.

- 1. Body Material: Gray iron.
- 2. Top or Strainer Material: Nickel bronze.
- 3. Top of Body and Strainer Finish: Nickel bronze.
- 4. Top Shape: Round.
- 5. Trap Material: Cast iron.
- 6. Trap Pattern: Deep-seal P-trap.
- 7. Trap Features: Trap seal primer valve drain connection.
- 8. Reference Section 224200 for additional alternate manufacturers.

2.7 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a) ProSet Systems Inc.
2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Position roof drains for easy access and maintenance.
- C. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- D. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 75 feet.
 4. Locate at base of each vertical soil and waste stack.
- E. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

- F. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- G. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- H. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- I. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- J. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- K. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- L. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- M. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.
- N. Install air vents at piping high points. Include ball, gate, or globe valve in inlet.
- O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

- C. Connect plumbing specialties to piping specified in other Division 22 and 23 Sections.
- D. Ground equipment.
- E. 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.
- F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221119

SECTION 221300 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Soil, Waste and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-DWV" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Non-pressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

2.2 CAST-IRON SOIL PIPING

- A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.

2.3 DUCTILE-IRON PIPING

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
 - 2. Ductile-Iron Piping, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111, rubber.
 - 2. Ductile-Iron, Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.

- a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
3. Ductile-Iron, Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
4. Ductile-Iron, Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
5. Ductile-Iron, Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

2.4 COPPER TUBING

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Hard Copper Tube: ASTM B 88, Type M, water tube, drawn temper.
 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.5 PVC PIPING

- A. PVC Pipe: ASTM D2665, Schedule 40, solid-wall drain, waste and vent (DWV).
 1. PVC Socket Fittings: ASTM D2665, socket type, made to ASTM D3311 DWV patterns.

2.6 PE ENCASUREMENT

- A. PE Encasement for Underground Metal Piping: ASTM A674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, Soil, Waste, and Vent Piping: Use any of the piping materials allowed in accordance with governing Plumbing Code unless otherwise noted.
- D. Underground, Soil, Waste, and Vent Piping: Use any of the piping materials allowed in accordance with governing Plumbing Code unless otherwise noted.

3.3 PIPING INSTALLATION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewer. Install as indicated and as required by governing Plumbing Code.
- C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for wall penetration systems.
- D. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- E. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- F. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated or dictated by local plumbing code:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- G. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 23 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 feet and less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer than 100 feet: MSS Type 43, adjustable roller hangers.
 - c. Longer than 100 feet, if indicated: MSS Type 49, spring cushion rolls.
 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 23 Section "Hangers and Supports."

- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4: 60 inches with 5/8-inch rod.
 - 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Specialties."
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch WG. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

- A. Exposed Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint; color to match adjacent finish.

END OF SECTION 221300

SECTION 221413 - STORM DRAINAGE PIPING (BUILDING – INTERIOR)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes storm-drainage piping inside the building and to locations indicated.
- B. Related Sections include the following:
 - 1. Division 22 Section "Plumbing Specialties" for storm drainage piping system specialties.

1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings: For controlled-flow storm drainage system, include calculations, plans, and details.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Non-pressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

2.2 CAST-IRON SOIL PIPING

- A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hub-less Pipe and Fittings: ASTM A 888 or CISPI 301.
- C. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center pipe stop.

2.3 STEEL PIPING

- A. Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

2.4 DUCTILE-IRON PIPING

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.

2.5 PE ENCASEMENT

- A. PE Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105 PE film, 0.008-inch minimum thickness, tube or sheet.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground Storm Drainage Piping: Use any of the following piping materials for each size range:
 - 1. NPS 2 to NPS 4: Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. NPS 2 to NPS 4: Hub-less, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 304 stainless steel.
 - b. Couplings: Heavy-duty, cast iron.
 - c. Couplings: Compact, stainless steel.
 - 3. NPS 2 to NPS 4: Steel pipe; cast-iron, threaded drainage fittings; and threaded joints.
 - 4. NPS 2 to NPS 4: Cellular-core, Schedule 40, PVC pipe; PVC socket fittings; and 5. solvent-cemented joints.
 - 6. NPS 6 and NPS 8: Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 7. NPS 6 and NPS 8: Hub-less, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 304 stainless steel.
 - b. Couplings: Heavy-duty, cast iron.
 - c. Couplings: Compact, stainless steel.
 - 8. NPS 6 and NPS 8: Steel pipe; cast-iron, threaded drainage fittings; and threaded joints.
 - 9. NPS 6 and NPS 8: Cellular-core, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.

3.3 PIPING INSTALLATION

- A. Refer to "Storm Drainage" (Civil) for Project site storm sewer and drainage piping.
- B. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers.
- D. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
- E. Encase piping with PE film according to ASTM A 674 or AWWA C105.
- F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- G. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for wall penetration systems.
- H. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- I. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.
- J. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

- M. Install force mains at elevations indicated.
- N. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hub-less Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 23 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 feet and less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer than 100 feet: MSS Type 43, adjustable roller hangers.
 - c. Longer than 100 feet, if indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 23 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.

- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3: 12 feet with 1/2-inch rod.
 - 2. NPS 4: 12 feet with 5/8-inch rod.
 - 3. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
- F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413

SECTION 22 34 36 - ELECTRIC DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following electric water heaters:
 - 1. Flow-control, instantaneous electric water heaters.
 - 2. Light-commercial electric water heaters.
 - 3. Compression tanks.
 - 4. Water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For electric water heaters to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period(s): From date of Substantial Completion:
 - a. Instantaneous Electric Water Heaters: One year.
 - b. Light-Commercial Electric Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: One year.
 - c. Compression Tanks: One year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 INSTANTANEOUS ELECTRIC WATER HEATERS

- A. Flow-Control, Instantaneous Electric Water Heaters: Comply with UL 499 for tankless electric (water heater) heating appliance.
 - 1. Manufacturers:
 - a. Chronomite Laboratories, Inc.
 - b. Eemax, Inc.

- c. Hot Aqua, Inc.
 - d. Stiebel Eltron, Inc.
2. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
- a. Connections: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Flow-control fitting.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
3. Support: Bracket for wall mounting.
4. Capacity and Characteristics:
- a. Temperature Control: Flow-control fitting.

2.3 LIGHT-COMMERCIAL ELECTRIC WATER HEATERS

- A. Description: Comply with UL 174 for household, storage electric water heaters.

- 1. Manufacturers:
 - a. Bradford White Corporation.
 - b. Lochinvar Corporation.
 - c. Smith, A. O. Water Products Company.
 - d. State Industries, Inc.
- 2. Storage-Tank Construction: Steel, vertical arrangement.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
- 3. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
 - e. Jacket: Steel with enameled finish.
 - f. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation, unless otherwise indicated.
 - h. Temperature Control: Adjustable thermostat for each element.
 - i. Safety Control: High-temperature-limit cutoff device or system.

- j. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

2.4 COMPRESSION TANKS

- A. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air pre-charge to minimum system-operating pressure at tank.

- 1. Manufacturers:

- a. AMTROL Inc.
- b. Armstrong Pumps, Inc.
- c. Flexcon Industries.
- d. Honeywell Sparco.
- e. Myers, F. E.; Pentair Pump Group (The).
- f. Smith, A. O.; Aqua-Air Div.
- g. State Industries, Inc.
- h. Taco, Inc.
- i. Watts Regulator Co.
- j. Wessels Co.

- 2. Construction:

- a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
- b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
- c. Air-Charging Valve: Factory installed.

2.5 WATER HEATER ACCESSORIES

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than water heater working-pressure rating.
- C. Water Heater Stand and Drain-Pan Units: High-density-polyethylene-plastic, 18-inch- high, enclosed-base stand complying with IAPMO PS 103 and IAS No. 2. Include integral or separate drain pan with raised edge and NPS 1 drain outlet with ASME B1.20.1 pipe thread.

- D. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- E. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.
- F. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that are capable of isolating each water heater and of providing balanced flow through each water heater.
- G. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- H. Water Regulators: ASSE 1003, water-pressure reducing valve. Set at 25-psig- maximum outlet pressure, unless otherwise indicated.
- I. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

2.6 SOURCE QUALITY CONTROL

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- B. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- C. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

- D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for hose-end drain valves.
- E. Install thermometer on outlet piping of water heaters.
- F. Install pressure gage(s) on inlet and outlet of commercial electric water- heater piping.
- G. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve, thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "Valves" for general-duty valves.
- H. Install water regulator, with integral bypass relief valve, in booster-heater inlet piping and water hammer arrester in booster-heater outlet piping.
- I. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- J. Fill water heaters with water.
- K. Charge compression tanks with air.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

END OF SECTION 22 34 36

SECTION 224200 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes plumbing fixtures and related components.

1.3 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

1.6 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. For fixture descriptions refer to schedule on drawings.

2.2 ALTERNATE ACCEPTABLE MANUFACTURERS

- A. Water Closets, Urinals, Lavatories - American Standard, Kohler, Toto.
- B. Sinks – Advance Tabco, Elkay, Just, Moen.
- C. Water Closet Seats – Bemis, Beneke, Church, Centoco, Toto.
- D. Lavatory/Sink Accessories – Advance Tabco, Chicago, Dearborn, McGuire.
- E. Undercounter Pipe Insulation Kits – Mainline, Plumberex, Truebro.
- F. Flush Valves – American Standard, Delta Commercial, Moen, Sloan, Toto, Zurn.
- G. Fixture Carriers – Mifab, Jay R Smith, Josam, Wade, Watts, Zurn.
- H. Faucets/Trim - American Standard, Delta Commercial, Elkay, Kohler, Moen, Toto.
- I. Electric Water Coolers – Elkay, Halsey-Taylor, Murdock, Oasis, Sloan.
- J. Service Sinks – E.L. Mustee, Fiat, Florestone, Mustee, Stern Williams, Swan, Zurn.
- K. Water Heaters - A.O. Smith, Bradford-White, Lochinvar, PVI, Rheem, State.
- L. Instantaneous Electric Water Heaters – Chronomite, Eemax, Hot Aqua, Stiebel Eltron.

- M. Expansion Tanks – Amtrol, Mainline, Watts, Wessels, Wilkins, Zurn.
- N. Wall Faucets, Hose Bibbs - Acorn, Jay R Smith, Josam, Mifab, Wade, Watts, Woodford, Zurn.
- O. Floor Drains, Floor Sinks, Roof Drains, Downspout Nozzles – Jay R Smith, Josam, Mifab, Sioux Chief, Wade, Watts, Zurn.
- P. Trap Primer Valves – Josam, Mifab, PPP, Sioux Chief, Zurn.
- Q. Mixing Valve Assemblies – Bradley, Leonard, Lawler, Powers, Symmons.
- R. Emergency Plumbing Fixtures – Acorn, Bradley, Chicago, Guardian.
- S. Backflow Preventers – Ames, Beeco, Febco, Watts, Wilkins.
- T. Water Hammer Arrestors - Josam, Mifab, Sioux Chief, Wade, Watts, Zurn.
- U. Cleanouts - Josam, Mifab, Sioux Chief, Wade, Watts, Zurn.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data where roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-hanging fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 22 Section "Valves" for general-duty valves.
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- Q. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for escutcheons.
- R. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures.
- C. Connect drain piping from fixtures to drainage piping.

- D. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
- E. Ground equipment.
 - 1. 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.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets, and flush valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

SECTION 230000 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE

1. The mechanical portion of this project includes all labor, materials, equipment, etc., required to provide the complete mechanical work to fulfill the intent of the Contract Documents.

1.2 RELATED DOCUMENTS

1. All applicable provisions of Division 0 and 1 govern work under this division. Refer to these articles in the specifications for additional information.
2. All work shall be in compliance with the currently enforced edition of the applicable state, national, and local ordinance and building codes. No additional compensation shall be granted for work which must be changed as a result of the work not originally complying with the codes and standards, etc.
3. Refer to each section for additional applicable codes and reference standards.

1.3 FEES, PERMITS AND TAXES

1. This Contractor is responsible for all inspection fees and permits required by local authorities having jurisdiction. The Contractor is also responsible for all taxes levied for labor and materials associated with the mechanical portion of the work. After completion of the work, a certificate of final inspection shall be provided showing approval from the local Inspector.

1.4 SUBMITTALS

1. Submittals shall be provided for all equipment, fixtures and other items indicated. Product data shall be from published manufacturer's data. Data shall include enough information so that the Engineer can verify compliance with codes, standards, and the contract documents. Submittal shall not contain data that is not relevant to the equipment being submitted. The data shall be highlighted by arrows, underlining, etc. Broad, general data, is not acceptable. Data shall be presented at one time, in a neatly bound and organized manner.
2. Submit a single electronic copy or a minimum of 5 copies of each required submittal. Electronic submittals shall be divided by individual specification division and only combined where total document size is less than 100 pages. The Engineer will return the copies marked with action taken and corrections or modifications required. Unless resubmittal is requested, the submittal may serve as the final submittal.

3. The contractor shall provide and maintain at the site a set of prints which accurately represent the actual installation of all work under this Division. Any changes in sizes, locations, dimensions, etc. shall be shown.
4. At the completion of the Project, a set of marked-up drawings, including DIMENSIONED, location of all underground piping shall be provided to the owner.

1.5 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

1. Operating and Maintenance Data includes printed information, such as manufacturer's installation instructions, manufacturer's service manuals, manufacturer's lubrication charts, standard wiring diagrams, and a parts list including the price of each item.
2. Mark each copy to show applicable choices and options. Where printed Operating and Maintenance Data includes information on several products that are not required, mark copies to indicate the applicable information.
3. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
 1. Operation Data:
 1. Emergency instructions and procedures.
 2. System, subsystem, and equipment descriptions, including operating standards.
 3. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
 4. Description of controls and sequence of operations.
 5. Piping and wiring diagrams.
 2. Maintenance Data:
 1. Manufacturer's information, including list of spare parts.
 2. Name, address, and telephone number of Installer or supplier.
 3. Maintenance procedures.
 4. Maintenance and service schedules for preventive and routine maintenance.
 5. Maintenance record forms.
 6. Sources of spare parts and maintenance materials.
 7. Copies of maintenance service agreements.
 8. Copies of warranties and bonds.
4. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.
5. Do not submit Operating and Maintenance Data until compliance with requirements of the Contract Documents has been confirmed.

1.6 PRIOR APPROVAL

1. The drawings and specifications are intended to indicate a standard of quality for items by identifying manufacturer's names and model numbers. It is the responsibility of the contractor to prove equality for any substitutions.

The contractor shall submit a list of proposed substitutions to the Engineer. All proposed substitutions shall be in writing to the Engineer, at least, ten (10) calendar days prior to bid opening. The submittal will list the proposed substitutions from published manufacturer's data, which cover the applicable features of the submitted equipment. Any approvals shall be issued in writing.

1.7 GUARANTEE

1. The contractor shall fully guarantee the installation against defects in materials and workmanship which may occur under normal usage for a period of one year after owner's acceptance. Defects shall be promptly remedied at no cost to the owner. This guarantee is in addition to, and not a limit to, any other guarantees or warranties.

1.8 DEFINITIONS. The following words and phases are defined:

1. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.
2. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect/Engineer, requested by the Architect/Engineer, and similar phrases.
3. "Approved": The term "approved," when used in conjunction with the Architect's/Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Architect's/Engineer's duties and responsibilities as stated in the Conditions of the Contract.
4. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
5. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
6. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

7. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
8. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform
9. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
10. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.9 INSPECTION OF THE SITE

1. The drawings are prepared from the most accurate information available. However, in order to insure responsible bidding by the contractor, he shall, prior to placing any bids, visit the site to verify existing conditions, the locations, sizes, depths, pressures, etc., of all existing utilities and become familiar with working conditions, hazards, existing grades, obstructions, local requirements involved, etc.
2. All proposals shall take these existing conditions and any speculated revisions needed into account. The contractor shall be fully responsible for his bid regardless of any additional site information which may be uncovered after a contract is signed.

1.10 CONSTRUCTION SAFETY

1. The plans and specifications do not include items necessary for the contractor to insure the safety of his personnel on the project construction site. Construction site safety for the project is the responsibility of the contractor. Reference other sections of these specifications for any additional information.

1.11 DAMAGE

1. The contractor shall be held accountable to repair, at no cost to the owner, any damage to existing wiring, piping, or other materials and equipment intended to remain.
2. The contractor shall be held accountable to repair, at no cost to the owner, any damage to project due to failure to recognize associated hazards such as leaks, scheduling of work, poor workmanship, excessive cutting, etc.

1.12 DRAWINGS AND SPECIFICATIONS

1. Should be considered as complimentary to each other. What is required by one shall be binding as if required by both. If conflicts between plans and specifications are found, the Engineer shall be contacted to secure clarification, prior to bidding. The contractor shall verify all dimensions and existing conditions.

PART 2 - EXECUTION

2.1 WORKMANSHIP

1. All work shall be done in a professional and complete manner by experienced craftsmen. Unsatisfactory workmanship shall be duly noted and corrected at the contractor's expense.
2. Only new materials shall be used, unless otherwise indicated on plan or prior approved.

2.2 MANUFACTURER'S INSTALLATION INSTRUCTIONS

1. All equipment shall be installed in accordance with manufacturer's installation instructions.

2.3 PROTECTION OF EQUIPMENT

1. The contractor shall provide protection of stored material and installed equipment against dirt, rust, moisture, and abuse from other trades. Where tarps or other cover is used, provide air circulation to prevent condensate build up. No materials or equipment shall be stored directly on the ground. Ductwork, piping and equipment are prohibited from use as scaffolding or personnel supports.
2. Upon completion of work, all equipment, fixtures, piping, etc., shall be cleaned to the satisfaction of the Architect. All repairs due to damage shall be at the Contractor's expense.

2.4 CONFLICTS, INTERFERENCES AND COORDINATION BETWEEN TRADES

1. Coordinate work so as to conform with the progress of the work of others. The drawings are only intended to indicate the extent, general location and arrangement, of piping systems, ductwork and equipment. The drawings are not to be construed as shop drawings. Any questions regarding the information given on the plans shall be directed to the Engineer for clarification. The contractor shall refer to other sections of the specifications and other drawings such as structural, electrical, etc., in order to eliminate conflicts when laying out his work. The contractor shall be responsible for the proper coordination of the mechanical work with the installations under other Divisions for clearances, etc. Any changes required to avoid interferences shall be submitted to the Architect for approval and shall be made, as approved, without additional cost to the Owner.

2. Code requirements shall have precedence over plans or specifications in the event of a conflict. If a discrepancy or conflict exists between specifications and drawings, drawings shall take precedence over specifications except as pertaining to quality. Manufacturer's installation instructions shall govern the installation of all equipment.
3. The contractor shall coordinate with equipment suppliers for any requirements specific to the equipment provided which may not be shown on the plans or given in the specifications. The contractor shall include the provision and installation of such requirements in his bid. The contractor shall coordinate with equipment suppliers, prior to bid, to determine what ancillary equipment is or is not provided with the equipment, such as bolts, gaskets, oils, drive belts, etc. Coordinate with Owner for owner supplied equipment.
4. Equipment requiring set grades or elevations and piping has precedence over ductwork, conduit, boxes, etc. as to location.
5. The contractor shall coordinate with other equipment providers to insure correct operation of the equipment, such as, phase rotation, interlocking, accessibility, etc.
6. The contractor shall examine the Architectural plans for the location of suitable openings and aisles for the passage of equipment to be installed under this Division. The contractor shall be responsible for having suitable openings and aisles left open until his equipment has been properly installed.
7. Except as otherwise noted, it shall be understood that the indication and/or description of any item, in the drawings or specifications, or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
8. The right is reserved to make reasonable changes in locations of equipment indicated in Drawings prior to installation without an increase in the contract cost.
9. The drawings and specifications do not undertake to indicate every item required to produce a complete and properly operational installation. Material, equipment or labor not indicated, but which can be reasonably inferred to be necessary for a complete installation shall be provided.

2.5 CUTTING AND PATCHING

1. Every effort shall be made to build-in the work as the job progresses. As required, cutting and patching for the installation of sleeves, piping, equipment, etc., shall be coordinated with the General Contractor. Do not cut any structural element without written permission from the Structural Engineer.

2.6 EQUIPMENT CONNECTIONS

1. The contractor shall make final connection of all required services to all equipment items furnished, including that provided by others or by the owner. Equipment shall be left in a ready to operate condition.

2.7 FLASHING AND WATERPROOFING

1. All building penetrations to the outside shall be flashed and sealed, as required, to prevent leaks.

2.8 DEMONSTRATION:

1. Engage a factory authorized service representative to train Owner's maintenance personnel to operate all mechanical systems.

END OF SECTION 230000

SECTION 230500 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 22 and 23 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Escutcheons.
 - 3. Dielectric fittings.
 - 4. Flexible connectors.
 - 5. Mechanical sleeve seals.
 - 6. Equipment nameplate data requirements.
 - 7. Labeling and identifying mechanical systems and equipment.
 - 8. Non-shrink grout for equipment installations.
 - 9. Installation requirements common to equipment specification sections.
 - 10. Cutting and patching.
 - 11. Touchup painting and finishing.
 - 12. Mechanical demolition.
- B. Pipe and pipe fitting materials are specified in Division 21 through 23 piping system Sections.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

- A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.
- B. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment rooms in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
 - 1. Planned piping layout, including valve and specialty locations and valve-stem movement.
 - 2. Required clearances for installing, servicing and maintaining equipment, insulation, accessories, and specialties, including space for disassembly required for periodic maintenance.
 - 3. Equipment and accessory service connections and support details.
 - 4. Exterior wall and foundation penetrations.
 - 5. Fire-rated wall and floor penetrations.
 - 6. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

1.5 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be incorporated into contract price. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces.
- G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. STEEL PIPING

- 1. Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
- 2. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
- 3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
- 4. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
- 5. Cast-Iron Flanges: ASME B16.1, Class 125.
- 6. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- 7. Grooved-End Fittings: ASTM A 47, malleable-iron casting; ASTM A 106, galvanized, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
- 8. Expansion Joints: Compound, galvanized, steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

9. Double Expansion Joints: Compound, galvanized, steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.
10. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

B. DUCTILE-IRON PIPING

1. Piping for fire-suppression applications shall be listed for fire-protection service.
2. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end, unless grooved or flanged ends are indicated.
3. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end, unless grooved or flanged ends are indicated.
4. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron, standard pattern; or AWWA C153, ductile-iron, compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
5. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron, standard pattern; or AWWA C153, ductile-iron, compact pattern.
 - a. Gaskets: AWWA C111, rubber.
6. Grooved-End Fittings: ASTM A 47, malleable-iron castings or ASTM A 536 ductile-iron castings with dimensions matching pipe.
 - a. Ductile-Iron-Piping, Keyed Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
7. Flexible Expansion Joints: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed, ball-joint sections and one or more gasketed, sleeve section. Assemble components for offset and expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
8. Deflection Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.
9. Expansion Joints: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111 ductile-iron glands, rubber gaskets, and steel bolts.

C. COPPER TUBING AND FITTINGS

1. DWV Copper Tube: ASTM B 306, drainage tube, drawn temper.
2. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
3. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
4. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
5. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
6. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
7. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
8. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
9. Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

D. CAST-IRON SOIL PIPING AND FITTINGS

1. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.
2. Hub-less Pipe and Fittings: ASTM A 888 or CISPI 301.
3. Gaskets: ASTM C 564, rubber.
4. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
5. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
 - a. NPS 1-1/2 to NPS 4: 3-inch-wide shield with 4 bands.
6. Compact, Stainless-Steel Couplings: CISPI 310 with ASTM A 167, Type 301, or ASTM A 666, Type 301, stainless-steel corrugated shield; stainless-steel bands; and sleeve.
 - a. NPS 1-1/2 to NPS 4: 2-1/8-inch-wide shield with 2 bands.

2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32.
 1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
 2. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.
- E. Brazing Filler Metals: AWS A5.8.
 1. BAg1: Silver alloy.
- F. Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- G. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- H. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

2.3 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.

2.4 FLEXIBLE CONNECTORS

- A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
 1. 2-Inch NPS and Smaller: Threaded.
 2. 2-1/2-Inch NPS and Larger: Flanged.

- B. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.
- C. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.6 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 - 1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
 - 2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 - 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.
 - 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
 - 5. PVC Pipe: ASTM D 1785, Schedule 40.
- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
 - 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
 - 2. OD: Completely cover opening.
 - 3. Cast Brass: One piece, with set screw.
 - a. Finish: Polished chrome-plate.
 - 4. Cast Brass: Split casting, with concealed hinge and set screw.
 - a. Finish: Polished chrome-plate.
 - 5. Cast-Iron Floor Plate: One-piece casting.

2.7 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22 and 23 Sections. If more than one type is specified for application, selection is installer's option, but provide one selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
 - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
 - 2. Location: Accessible and visible location.

2.8 GROUT

- A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 22 piping Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved by the Engineer in writing.
- C. Install piping at slope indicated on plan, in these specifications, or as required by governing codes.
- D. Install components with pressure rating equal to or greater than system operating pressure.
- E. Install piping in concealed locations, except in equipment rooms and service areas.
- F. Install piping free of sags and bends. Decrease hanger spacing if required.
- G. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

- H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- K. Install fittings for changes in direction and branch connections.
- L. Install couplings according to manufacturer's written instructions.
- M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
 - 1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
 - 2. Uninsulated Piping Wall Escutcheons: Cast brass, with set screw.
 - 3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
 - 4. Insulated Piping: Cast brass; with concealed hinge, spring clips, and chrome-plated finish.
 - 5. Piping in Utility Areas: Cast brass, with set-screw or spring clips.
- N. Sleeves are not required for core drilled holes.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Build sleeves into new walls and slabs as work progresses.
 - 3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
 - b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 1) Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
 - 5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

- P. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter.
- Q. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire-stopping materials.
- S. Verify final equipment locations for roughing-in.
- T. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
 4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
 7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
- U. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Engineer.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- E. Install equipment giving right of way to piping installed at required slope.
- F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 1. Stenciled Markers: According to ASME A13.1.
 2. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior non-concealed locations:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
 - c. Near locations if pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.

- e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum of 25-foot intervals along each run. Reduce intervals to 15 feet in congested areas of piping and equipment.
 - g. Pipe Identification:
 - 1) Domestic Water: Grey.
 - 2) Automatic Fire Sprinkler: Fire Red.
 - 3) Natural Gas: Safety Yellow.
- B. Equipment: Install equipment marker on or near each major item of mechanical equipment.
- 1. Stenciled Markers: According to ASME A13.1
 - 2. Lettering Size: Minimum 1-inch-high lettering for name of unit if viewing distance is less than 24 inches, 2-inch-high lettering for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
 - 3. Text of Signs: Provide name of identified unit to match name of unit indicated on plan. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with stenciled signs and arrows, showing duct system service and direction of flow.
- 1. Location: In each space, if ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 25 feet.

3.4 PAINTING AND FINISHING

- A. Refer to Section "Painting" for paint materials, surface preparation, and application of paint.
- B. Apply paint to exposed piping according to the following, unless otherwise indicated:
- 1. Interior Piping and Supports: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 - 2. Exterior Piping and Supports: Use semi-gloss, acrylic-enamel finish. Include two finish coats over primer, for ferrous pipe applications use rust-inhibitive metal primer.
 - a. Primer shall be a different color than undercoat and undercoat shall be a different color than the finish coat.
 - b. Allow sufficient time for each coat to fully dry prior to applying the next coat.
- C. Do not paint piping specialties with factory-applied finish.
- D. Damage and Touch-up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.6 DEMOLITION

- A. Disconnect, demolish, and remove Work indicated on plans.
- B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.7 GROUTING

- A. Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placing of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout around anchors.
- G. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 230500

SECTION 230529 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for mechanical system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for "The Valve and Fittings Industry Inc."
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 1. AAA Technology & Specialties Co., Inc.
 2. Bergen-Power Pipe Supports.
 3. B-Line Systems, Inc.; a division of Cooper Industries.
 4. Carpenter & Paterson, Inc.
 5. Empire Industries, Inc.
 6. ERICO/Michigan Hanger Co.
 7. Globe Pipe Hanger Products, Inc.
 8. Grinnell Corp.
 9. GS Metals Corp.
 10. National Pipe Hanger Corporation.
 11. PHD Manufacturing, Inc.
 12. PHS Industries, Inc.
 13. Piping Technology & Products, Inc.
- C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

- a. Hilti, Inc.

- b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.

- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
 7. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
 8. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
 9. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
 10. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
 11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 12. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
 13. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 14. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 15. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 16. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
 17. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 18. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

- a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- J. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- L. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - 5. Insert Material: Length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 230529

SECTION 230593 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:

- 1. Air Systems:
 - a. Constant-volume air systems.
- 2. HVAC equipment quantitative-performance settings.
- 3. Verifying that automatic control devices are functioning properly.
- 4. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

- A. Adjust: To regulate air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- F. RC: Room criteria.
- G. Report Forms: Test data sheets for recording test data in logical order.

- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. TAB: Testing, adjusting, and balancing.
- K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- L. Test: A procedure to determine quantitative performance of systems or equipment.
- M. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

- A. Qualification Data: Within 45 days from Contractor's Notice to Proceed, submit 6 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- C. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by NEBB.
- B. TAB Report Forms: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." Or TAB firm's forms approved by Architect.
- C. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- D. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
 - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
 - 2. Verify that balancing devices, such as test ports, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

- E. Examine equipment performance data including fan curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- L. Examine equipment for installation and for properly operating safety interlocks and controls.
- M. Examine automatic temperature system components to verify the following:
 - 1. Dampers and other controlled devices are operated by the intended controller.
 - 2. Dampers are in the position indicated by the controller.
 - 3. Integrity of dampers for free and full operation and for tightness of fully closed and fully open positions.
 - 4. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 5. Sensors are located to sense only the intended conditions.
 - 6. Sequence of operation for control modes is according to the Contract Documents.
 - 7. Controller set points are set at indicated values.
 - 8. Interlocked systems are operating.
 - 9. Changeover from heating to cooling mode occurs according to indicated values.
- N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Cut insulation, ducts and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- C. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- D. Verify that motor starters are equipped with properly sized thermal protection.
- E. Check dampers for proper position to achieve desired airflow path.
- F. Check for airflow blockages.
- G. Check condensate drains for proper connections and functioning.
- H. Check for proper sealing of air-handling unit components.
- I. Check for proper sealing of air duct system.

3.4 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:

- a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.5 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.6 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or non-grounded power supply.
- J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.7 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Exhaust and Return: Plus or minus 5 percent.
 - 2. Air Outlets and Inlets: Plus or minus 5 percent.

3.8 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Contractor's name and address.
 - 6. Report date.
 - 7. Signature of TAB firm who certifies the report.
 - 8. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 9. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 10. Nomenclature sheets for each item of equipment.
 - 11. Data for terminal units, including manufacturer, type size, and fittings.
 - 12. Notes to explain why certain final data in the body of reports varies from indicated values.
 - 13. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside- and return-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.
 - f. Other system operating conditions that affect performance.

D. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
 - j. Number of belts, make, and size.
 - k. Number of filters, type, and size.
2. Motor Data:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches WG.
 - c. Fan rpm.
 - d. Discharge static pressure in inches WG.
 - e. Filter static-pressure differential in inches WG.
 - f. Outside airflow in cfm.
 - g. Return airflow in cfm.

E. Fan Test Reports: For exhaust fans, include the following:

1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.

2. Motor Data:

- a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
3. Test Data (Indicated and Actual Values):
- a. Total airflow rate in cfm.
 - b. Total system static pressure in inches WG.
 - c. Fan rpm.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes semi-rigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 22 Section "Pipe Insulation" for insulation for piping systems.
 - 2. Division 23 Section "Metal Ducts" for duct liner.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Removable insulation sections at access panels.
 - 2. Application of field-applied jackets.
 - 3. Applications at linkages for control devices.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate clearance requirements with duct installer for insulation application.

1.7 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - d. Schuller International, Inc.
 - 2. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

- C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
1. Adhesive: As recommended by insulation material manufacturer.
 2. PVC Jacket Color: White or gray.
 3. PVC Jacket Color: Custom color selected by the architect.
- D. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209, and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.
1. Finish: Smooth finish.
 2. Finish: Cross-crimp corrugated finish.
 3. Finish: Stucco-embossed finish.
 4. Finish: Factory-painted finish.
 5. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, pre-sized a minimum of 8 oz./sq. yd..
1. Tape Width: 4 inches.
- B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
 2. Galvanized Steel: 0.005 inch thick.
 3. Aluminum: 0.007 inch thick.

4. Brass: 0.010 inch thick.
 5. Nickel-Copper Alloy: 0.005 inch thick.
- C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.
- D. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
1. Welded Pin Holding Capacity: 100 lb for direct pull perpendicular to the attached surface.
- E. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.
- F. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
- O. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- P. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 4. Impale insulation over anchors and attach speed washers.
 5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
 8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.

10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.
- B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Space anchor pins as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
 8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

- A. Apply insulation to ducts and plenums as follows:
1. Follow the manufacturer's written instructions for applying insulation.
 2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.

3.6 FIELD-APPLIED JACKET APPLICATION

- A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
 - 1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 - 2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
 - 3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.7 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Section "Painting."
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.
- C. Insulate the following plenums and duct systems:
 - 1. Indoor concealed supply-, return-, outside- and exhaust-air ductwork.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Testing agency labels and stamps.
 - 8. Nameplates and data plates.
 - 9. Access panels and doors in air-distribution systems.

3.9 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Rectangular/round, air ducts, concealed (exterior).
1. Material: Mineral-fiber blanket.
 2. Thickness: 3.0 inches.
 3. Thermal Resistance Rating: R-8.2, installed (minimum).
 4. Number of Layers: One.
 5. Field-Applied Jacket: As noted per plans.
 6. Vapor Retarder Required: Yes.
- B. Service: Rectangular/round, air ducts, concealed (interior).
1. Material: Mineral-fiber blanket.
 2. Thickness: 2.2 inches.
 3. Thermal Resistance Rating: R-6.0, installed (minimum).
 4. Number of Layers: One.
 5. Field-Applied Jacket: Foil and paper.
 6. Vapor Retarder Required: Yes.

END OF SECTION 230713

SECTION 230800 - COMMISSIONING OF MECHANICAL SYSTEMS

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 commissioning process requirements for mechanical systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Participate in mechanical systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.

- F. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.5 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual mechanical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing, adjusting, and balancing of work are complete.
- D. Provide test data, inspection reports, and certificates in systems manual.

1.6 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for mechanical systems, assemblies, equipment, and components to be verified and tested.
 - 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
 - 5. Certificate of readiness certifying that mechanical systems, subsystems, equipment, and associated controls are ready for testing.
 - 6. Test and inspection reports and certificates.
 - 7. Corrective action documents.
 - 8. Verification of testing, adjusting, and balancing reports.

1.7 SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

- A. Certify that mechanical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that mechanical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TESTING AND BALANCING VERIFICATION

- A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.
- C. Provide technicians, instrumentation, and tools to verify testing and balancing of mechanical systems at the direction of the CxA.
 - 1. The CxA will notify testing and balancing subcontractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing and balancing subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.

3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of mechanical testing shall include entire mechanical installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the mechanical subcontractor, testing and balancing subcontractor and mechanical Instrumentation and Control subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the mechanical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.
- B. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- C. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.
- D. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.
- E. Unitary direct expansion HVAC split system and packaged air handling units, exhaust fans/systems and domestic service water heating equipment. Provide technicians, instrumentation, tools, and equipment to test performance of all system components.

END OF SECTION 230800

SECTION 230915 – INTEGRATED AUTOMATION SYSTEM (IAS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.02 SCOPE OF WORK

- A. This project requires the installation of a new Integrated Automation System constructed using a Niagara Framework with BACnet Field Level Devices. The new IAS shall utilize a single JACE 8000 controller, networked with a Niagara Framework Web Supervisor and identify device type for existing or new systems control devices.
- B. The Contractor will be required to perform the following:
 - 1. Furnish, install, configure and commission a new Niagara Framework with BACnet fully programmable and application specific DDC controllers for the equipment identified in the drawings including all components, software and applications required to meet the sequence of operation and the design/performance intent of the systems; new rooftop units and BACnet thermostats as noted and list all equipment to be controlled and/or monitored.
 - 2. Provide Application Specific Controllers (ASCs) and Programmable Control Units (PCUs) as specified herein and as indicated on the drawings. Provide I/O and ancillary devices as specified herein, as indicated on the IAS drawings, and as necessary to perform the sequences of operation. Provide Niagara Framework-based certified products that communicate on free topology, MS/TP, bus topology, or IP channels to meet the functional specifications.
 - 3. Provide BACnet BTL AWS (Advanced Work Station) certification for the Control System Server (CSS). All Network Controllers (NCs) shall be BTL BBC certified.
 - 4. Furnish and install all low voltage step-down transformers with associated low voltage connections, power supplies and power/communication/input/output cabling necessary for the control system.
 - 5. Furnish and install conduit, junction boxes, fittings, panels, enclosures, and hardware as specified in these specifications, on the drawings and as required by Code.
 - 6. Provide Graphical User Interface Development for all of the devices identified above and illustrated within the drawings.
 - 7. It is the contractor's responsibility to review all of the design documents and specifications and report any discrepancies to the owner.

1.03 GENERAL IAS INSTALLATION SCOPE OF WORK

- A. Contractor shall implement a Niagara Framework based open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project. Only Niagara Framework based products are acceptable.
- B. The Owner shall receive ownership of all job specific configuration documentation, data files and application-level software developed for the project. This shall include all custom, job specific software code, databases and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for admin and programming level access to any component or software program shall be provided to the Owner.
- C. It is the owner's intent to purchase an open system capable of being serviced and expanded by any acceptable system integrator that has and maintains certification (TCP) to work on Niagara Framework systems. The Niagara Compatibility Statement (NICS) for all Niagara Software shall allow open access and be set as follows: accept.station.in="*" accept.station.out="*" accept.wb.out="*" accept.wb.in="*". In any case, the Owner shall maintain the right to direct contractor to modify any software license, regardless of supplier, as desired by the Owner. The Contractor shall not install any "brand specific" software, applications or utilities on Niagara Framework based devices.
- D. All hardware and field level devices installed, (i.e.; ASCs, PDUs), for the project shall not be limited in their ability to communicate with a specific brand of Niagara Framework device. They shall also be constructed in a modular fashion to permit the next generation and support components to be installed in replace of or in parallel with existing components.
- E. Provide and install all wiring required for a complete system, including communication bus, analog points, digital points, low voltage power, emergency power, and spare communication bus. Splices are not permitted within the IAS FAC LAN or DLN communication cables. Only continuous bus topologies, MS/TP or continuous homeruns are allowed for these networks. Capacity of any bus shall be limited to 80% of the allowable device count to allow for future minor modifications or expansions to the network.
- F. Provision of all documentation called out in these specifications including, but not limited to, submittals, O&M manuals, commissioning submittals, CAD based as-built documentation, and training manuals. Provide both hard copies and electronic files on electronic media.
- G. Training of facility personnel, and or maintenance contractor, on the operation and maintenance of the system.
- H. The repair of all finished surfaces effected as a result of IAS related installation work. This includes but is not limited to carpet, drywall, paint, ceiling tiles, furniture, and the like.
- I. System point to point check out, verification and documentation. Assist the Owner/CxA, and/or TAB Firm in verification and functional performance testing and GUI acceptance testing.

- J. Graphical User Interface Development. The Contractor shall develop the graphics, tools, features, and network integration as required.

1.04 CONTROL DIAGRAMS AND SCHEDULE

- A. The control diagrams and schedules are an integral part of the control system design. Together the specifications, design drawings and schedules will provide a complete design. It is important that these documents be completed to a level of detail that will enable the performance expectations for the project to be realized. It is the design engineer's responsibility to insure the requirements of the open system are properly defined, referenced and enforced.
- B. Refer to Mechanical Design Drawings for information on the components and intended control functions.

1.05 SEQUENCES OF OPERATION

- A. Program each Niagara Framework Network Controller, and third party ASC, PCU, device, etc., to perform the sequences of operation provided on the construction documents coordinate with drawings. Provide all necessary hardware on each piece of equipment in order for the equipment to perform the specified sequence and to meet the requirements of the point lists.
- B. The Contractor shall be responsible for all control wiring connections, auxiliary devices and control wiring diagrams to complete the control system and attain the described sequence of operation.

1.06 CODES

- A. Comply with all current codes, ordinances, regulations, and the City of Tyler, TX requirements.

1.07 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this project unless identified by a specific edition date.
- B. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - 2. American National Standards Institute (ANSI)
 - 3. BACnet Testing Lab

1.08 COORDINATION OF WORK WITH EXISTING CONDITIONS

- A. Certain BACnet or other similar products, systems and interface devices may be provided by other trades. Examine the Contract Documents to ascertain the requirements to install, wire, program, commission, and/or interface to these systems. Particular attention must be paid towards the interface boards submitted by the various equipment providers. It is the Contractor's responsibility to verify the submitted interfaces will integrate properly into the IAS. Report any discrepancies to the Owner.

- B. Wherever work interconnects with work of other trades, coordinate with other trades and with the Owner's representative to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment.
- C. Provide sleeves and conduit for passage of pipes, and wiring through structural masonry, concrete walls and floors, and elsewhere for the proper protection of the IAS work.

1.09 PARTS LIST

- A. As part of the submittal, provide an accurate parts list including manufacturer, model number and quantity for all hardware and software.

1.10 DEFINITIONS AND ABBREVIATIONS

- A. Clarify terms unique to the project, coordinate with drawings.

1.11 QUALITY ASSURANCE

- A. Provide a Niagara Framework as the basis of the new IAS. The Contractor shall be fully certified in the development and customization of the Niagara Framework software.
- B. All microprocessor based control products used shall conform to LONMARK® Certified Interoperability Standards, BTL Certified Standards, Modbus communication standards and/or Niagara Framework.
- C. The IAS and components shall be listed by Underwriters Laboratories (UL 916) as an Energy Management System.
- D. Functionality and Completeness: Contractor shall furnish and install all hardware, software and programming necessary to provide a complete and functioning system as specified. Contractor shall include all hardware, software and programming not specifically itemized in these Specifications, which is necessary to implement, maintain, operate, and diagnose the system in compliance with these Specifications.

1.12 INSTALLER'S QUALIFICATIONS

- A. Installer's Qualifications: The Contractor shall have a successful history in the design and installation of Niagara Framework based Integrated Automation Systems to provide web browser monitoring and control of BACnet field level devices. Contractor must demonstrate experience in IAS installations for not less than 5 years and in DDC installation projects with point counts equal to this Project and systems of the same character as this Project.
- B. Installer's Experience with Proposed Product Line: Firms shall have specialized in and be experienced with the installation of the proposed product line for not less than one year from date of final completion on at least three (3) projects of similar size and complexity. Submittals shall document this experience with references. Provide evidence of Niagara TCP certification as part of the submittal process.

1.13 BID PACKAGE SUBMITTAL

- A. Provide the following submittals as part of the bid package.

1. Proposed device schedule including all hardware and software.
2. Qualifications
3. One-line diagram indicating how the new Niagara Framework network controllers will integrate with IAS BACnet field level devices.
4. An overall sequence of the construction as it pertains to the installation of the Integrated Automation System.

1.14 SUBMITTALS

- A. Electronic Submittals: While all requirements for hard copy submittal apply, IAS control submittals and operation and maintenance (O&M) information shall also be provided in electronic format as follows:
 1. Drawings and Diagrams: Shop Drawings shall be provided on electronic media as an AutoCAD drawing per Owner's CAD standards.
 2. Other Submittals: All other submittals shall be provided in Adobe Portable Document Format
- B. Qualifications: Manufacturer, Installer, and Key personnel qualifications as indicated for the appropriate items.
- C. Submit a list of no less than three similar projects, which utilize the Niagara Framework for Enterprise connectivity to provide an Integrated Automation System that consists of web-browser control and monitoring of the proposed BACnet field level devices. These projects must be on-line and functional such that representatives from the Owner can observe the Integrated Automation System and Interface in full operation. Include proper references and contact numbers of these reference projects.
- D. Submit validation which indicates the successful completion of the Niagara Framework TCP certification course.
- E. Submit resumes of installing staff indicating passing certificates for training on the BACnet and Tridium TCP certification line of controls to be installed as part of this project.
- F. GUI development software
 1. Provide screen captures of graphical user interfaces developed by the Contractor on previous projects. These screen shots shall represent work performed by the contractor and not of the company from the line of controls which the Contractor represents. Provide client contact information for the Owner to validate.
- G. Product Data: Submit manufacturer's technical product data for each Niagara Framework based Network Controller, control device, sensor, actuator, relay, panel, and accessory furnished, indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation and start-up instructions.

- H. Products: Within twenty one (21) days after date of execution of General Contractor/Sub-Contractor agreement, submit for acceptance a list of all material and equipment manufacturers whose products are proposed, as well as names of all subcontractors whom the Contractor proposes to employ.
- I. Submit documentation indicating NICs and/or BTL compliance and include Protocol Implementation Conformance (PIC) Statements.
- J. Submit Shop Drawings for each control system.
- K. Control Logic Documentation:
 - 1. Provide a written description of each control sequence.
 - 2. Include control response, settings, set-points, throttling ranges, gains, reset schedules, adjustable parameters and limits as part of as-built documentation.
- L. Submit an IAS Start-Up Test Agenda and Schedule for review and approval.
- M. Record Documents:
 - 1. Provide record copies of product data and control Shop Drawings updated to reflect the final installed condition.
 - 2. Accurately record actual set points and settings of controls, final sequence of operation, including changes to programs made after submission and approval of Shop Drawings and including changes to programs made during specified testing.
 - 3. Record copies shall include individual floor plans with device (controllers, routers, sensors, etc.) locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring.

1.15 SYSTEM ARCHITECTURE

- A. The system provided shall incorporate hardware and software resources sufficient to meet the functional requirements of these Specifications. The Facility Local Area Network (FAC LAN) and Device Level Network (DLN) shall be based on industry standard open platforms as specified herein and utilize commonly available operation, management and application software. All software packages and databases shall be licensed to the Owner to allow unrestricted maintenance and operation of the IAS. Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.
- B. The system architecture shall implement a new building IAS which is based on the Niagara Framework and consists of an Ethernet-based, wide area network (WAN), a single Local Area Network (LAN) that supports NCs, PCUs, ASCs, Operator Workstations (OWS), Smart Devices (SD), and Remote Communication Devices (RCDs) as applicable.
 - 1. WAN: Internet-based network connecting multiple facilities with a central data warehouse and server, accessible via standard web-browser. This is an existing infrastructure and Contractor is not required to configure any components of this WAN.

2. Facility Local Area Network (FAC LAN): The FAC LAN shall be an Ethernet-based, 10/100/1000 Ethernet LAN connecting Local NCs, IAS Server and OWSs. The FAC LAN serves as the backbone for the NCs communications path and as the connection point to the WAN. Contractor shall provide a FAC LAN as a dedicated LAN for the control system. LAN shall be IEEE 802.3 Ethernet over Fiber or Category 6 cable with switches and routers that support 1000base-T gigabit Ethernet throughput.
 3. Device Level Network (DLN): Network used to connect PCUs and ASCs. These shall be Peer to Peer or Master/Slave devices as defined in the Sedona or BTL standard.
 4. ARCnet and/or Token-Ring based FAC LANs and DLNs shall not be acceptable.
- C. Remote Data Access: The system shall support the Internet Browser-based remote access to the building data. The IAS contractor shall coordinate with the Owner's IT department to insure all remote browser access (if desired by the owner) is protected with the latest Niagara Software updates and a VPN (Virtual Private Network) must be installed to protect the owner's network from cyber attacks.
- D. Browser-based access: A remote/local user using a standard browser will be able access all control system facilities and graphics via the WAN or direct connection, with proper username and password. Only native Internet browser-based user interfaces (HTML5, Java, XML, CCS3 JAVA Script, etc.) that do not require plug-ins (thin clients) are acceptable. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Firefox™ or Chrome™.
- E. The communication speed between the controllers, LAN interface devices, CSS, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition.
- F. Niagara Framework Control Systems Server (CSS): A server that maintains the systems configuration and programming database. It shall allow secure multiple-access to the control information.
- G. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on a server that resides on the FAC LAN. User tools for DLN and FAC LAN management shall be provided and licensed to the Owner and shall allow unrestricted configuring, updating, maintaining, and expanding of all current devices, configurations and settings.
- H. Database Schema shall be published and provided to the Owner to facilitate easy access to DLN and FAC LAN data.

1.16 SUBSTITUTIONS

- A. Wherever the words "for review" or "for acceptance" are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of apparatus for that specified, submit all information pertinent to the adequacy and adaptability of the proposed apparatus to the Owner's Representative and secure their approval before the apparatus is ordered. Refer to general condition requirements for substitutions.

1.17 WARRANTY

- A. The entire IAS and all ancillary equipment required for its operation shall be free from defects in workmanship and material under normal use and service. If within 12 months from the date of substantial completion the installed equipment is found to be defective in operation, workmanship or materials, the Contractor shall replace, repair or adjust the defect at no cost to the Owner.
- B. The warranty period for work and systems of this project shall commence after written notification of Owner's final acceptance.
- C. Corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.
- D. The Owner reserves the right to make changes to the IAS during the Warranty Period. Such changes do not constitute a waiver of warranty. Contractor shall warrant parts and installation work regardless of any such changes made by Owner, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the IAS.
- E. At no cost to the Owner, during the Warranty Period, Contractor shall provide maintenance services for software including all current software updates, firmware and hardware PRODUCTS. Prior to the closeout of the warranty period, the IAS contractor shall meet with the owner's representative to address any questions or concerns and offer ongoing Software Maintenance Services to the owner.

1.18 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

1.19 MANUFACTURERS

- A. Network Controllers
 - 1. Niagara Framework JACE
 - 2. Any reference in this Specification to brand names or to a specific manufactured product without the use of "or approved equal" is to be interpreted to mean that the specific article or product is the only one to be supplied or used.
 - 3. All approved bidders must be Systems Integrators and specialty control contractors in the business of installing IBMS systems and direct digital temperature controls. Subject to the provisions of these specifications, provide an IBMS/DDC/control system from one of the following manufacturers:
 - a. Delta Controls
 - b. Prior-approved equal.

1.20 MATERIALS AND EQUIPMENT

- A. Materials shall be new, the best of their respective kinds without imperfections or blemishes, and shall not be damaged in any way. Used equipment shall not be used in any way for the permanent installation except where Drawings or Specifications specifically allow existing materials to remain in place.
- B. The make and model of network switches, routers, ups, control system server computers, personal computers (PC), notebook PC's, and monitors shall comply with Owner's current standards as of the date of Substantial Completion. Contact Owner for the current hardware standards.
- C. List important field device, input and output requirements including specifications for critical sensors, actuators, valves, relays, etc.

1.21 STAND-ALONE FUNCTIONALITY

- A. The Contractor shall furnish and install single controllers with the physical and software resource count for standalone operation of each piece of equipment (e.g. RTU, thermostats, etc.). The sequence of operation and required points for control shall reside on a single controller. Remote I/O modules (via a field wired communications bus) are not acceptable for points required to achieve the sequence of operation. Expansion I/O modules plugged directly into the controller may be utilized for expansion.

1.22 THIRD PARTY INTERFACES

- A. Manufacturer third party interfaces shall be limited to equipment which the IAS contractor cannot or has not been contracted to control directly via DDC controllers.

1.23 ENERGY MANAGEMENT APPLICATIONS

- A. The IAS shall have the ability to perform energy management routines via preprogrammed function blocks or template programs.

1.24 UNIFORMITY

- A. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer.

PART 2 - EXECUTION

2.01 PREPARATION

- A. Examine areas and conditions under which control systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- B. These specifications call out certain duties of the Contractor and any subcontractor(s). They are not intended as a material list of all items required by the Contract.

2.02 INSTALLATION

- A. Utilize licensed electricians for all new and retrofitted electrical distribution systems and comply with Division 26 electrical specifications.
- B. Provide related items and work indicated on the drawings and items and work called for in this Division of the Specifications. This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start up, configuration, programming and commissioning coordination on each control product and system to provide fully operable systems in accordance with the specified functional performance.
- C. Installation shall be in accordance with manufacturer's published recommendations and shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- D. The drawings show the general arrangement of the respective systems. Follow these Drawings as closely as actual building construction and the work of other trades will permit. Provide devices, power, fittings, sensors, controllers, wiring and accessories, which may be required but are not shown on the Drawings or specified herein. The Contractor shall be responsible for achieving the sequence of operations and intent of the system design.
- E. All installation shall be in accordance with manufacturer's published recommendations.
- F. Limit LAN cable lengths to no longer than 80% of the longest dimension published by the manufacturer of the cable between the most remote network nodes.
- G. Comply with all rules, guidelines and procedures defined by the owner's IT authority.

2.03 DIGITAL CONTROL PANELS, CONTROLLER QUANTITY AND LOCATION

- A. Individual Digital Control Panels (DCP) are referenced to indicate allocation of points to each DCP and DCP location. Digital control panels shall consist of one or multiple controllers to meet requirements of this Specification.
- B. Contractor shall extend power to the DCP from an acceptable power panel (coordinate with Division 26).

2.04 NETWORK MANAGEMENT FUNCTIONAL REQUIREMENTS

- A. Contractor shall thoroughly and completely configure IAS system control devices, software, supplemental software, application programming, network communications, CSS, OWS, remote operator workstations, portable operator's terminal, printer, and network communications to permit the functional requirements of the IAS herein specified. The setup shall include as a minimum the following network management procedures:
 - 1. Automatic backup of the DDC System database to appropriate media.
 - 2. Program, load and debug all software installations, including integration of third party applications (e.g. analytics and energy management).
 - 3. Network user auditing routine.

2.05 SURGE PROTECTION

- A. Contractor shall furnish and install any power supply surge protection, filters, etc. as necessary for proper operation and protection of all NCs, operator interfaces, printers, routers and other hardware and interface devices. All equipment shall be capable of handling voltage variations 10 % above or below measured nominal value, with no affect on hardware, software, communications, and data storage.

2.06 CONTROL POWER SOURCE AND SUPPLY

- A. IAS Contractor shall provide all power source wiring required for operation of all equipment and devices provided under Division 23 and the Drawings.

2.07 PRODUCT DELIVERY, STORAGE, HANDLING, PROTECTION AND CLEANING

- A. All products and materials shall be new, clean, and free of defects, damage and corrosion.
- B. Ship and store products and materials in a manner which will protect them from damage, weather, and entry of debris until final acceptance.

2.08 SITE CLEAN UP

- A. At conclusion of each day's work, and at the request of the owner, clean up and remove from the site all rubbish, debris and trash accumulated during the day as a result of work of the Contractor.
- B. Marks on walls or ceiling tiles caused by the Contractor shall be cleaned by the Contractor. Ceiling tiles, drywall, carpet, paint, and all building finishes damaged by the Contractor shall be replaced by the Contractor.

2.09 IAS CONTRACTOR'S CHECK OUT (CCO) START-UP TESTING, ADJUSTING, CALIBRATION

- A. Work and/or systems installed under this Division shall be fully functioning prior to Demonstration and Acceptance Phase. Contractor shall conduct the CCO which addresses the start-up, testing, adjustments, and calibrations of all work and/or systems under this Contract.
- B. All CCO testing procedures shall be documented in the CCO report to be provided by the contractor to the Owner.

2.10 SUMMARY OF IAS ACCEPTANCE PROCEDURE

- A. Submit product data, Shop Drawings, logic documentation, and sample graphics to the Engineer of Record, and receive approval.
- B. Submit as-built record documents.
- C. Provide the Owner an agenda and schedule of CCO testing activities for approval and coordination.
- D. Provide written notice that the system is ready for Owner acceptance testing. Schedule IAS Demonstrations and Owner.

- E. Demonstrate IAS systems to Owner/Engineer. Perform functional performance testing including sequence of operation, point to point verification to graphical interface, historical data logging, and alarms.
- F. Owner/Engineer to provide detailed punch list to contractor.
- G. Contractor to repair issues on Owner punch list in seven (7) calendar days.
- H. Contractor provides all usernames, passwords, software, GUI, databases, licenses, and application programming tool(s) to the Owner.
- I. Contractor Trains Owner on all aspects of the IAS including architecture, devices, software, final sequences and modes of operation.
- J. Owner issues letter to contractor declaring that system is substantially complete. Date of this letter starts the warrantee period,
- K. Revise and re-submit as-built record Drawings and O&M Manuals.
- L. Final Acceptance. Owner issues letter to contractor accepting system.

END OF SECTION 230915

SECTION 231123 - NATURAL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes fuel gas piping within the building. Products include the following:
 - 1. Pipe, tube, fittings, and joining materials.
 - 2. Piping specialties.
 - 3. Specialty valves.
 - 4. Pressure regulators.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 2. Pressure regulators. Include pressure rating, capacity, and settings of selected models.
- B. Welding certificates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For natural gas specialties and accessories to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. NFPA Standard: Comply with NFPA 54, "National Fuel Gas Code."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

1.6 COORDINATION

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

- A. Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; black. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
 - 2. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
 - 3. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
 - 4. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
 - 5. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
 - 6. Joint Compound and Tape: Suitable for natural gas.
 - 7. Steel Flanges and Flanged Fittings: ASME B16.5.
 - 8. Gasket Material: Thickness, material, and type suitable for natural gas.

2.3 PROTECTIVE COATING

- A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in contact with materials that may corrode the pipe.

2.4 PIPING SPECIALTIES

- A. Flexible Connectors: ANSI Z21.24, copper alloy.

2.5 SPECIALTY VALVES

- A. Valves: Threaded ends according to ASME B1.20.1 for pipe threads.
- B. Appliance Connector Valves: ANSI Z21.15 and CSA International listed.
- C. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.
- D. Gas Valves: ASME B16.33 and CSA International-listed bronze body and 125-psig pressure rating.
 - 1. Tamperproof Feature: Include design for locking.

2.6 PRESSURE REGULATORS

- A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.
 - 1. Threaded ends according to ASME B1.20.1 for pipe threads.
 - 2. Line Pressure Regulators: ANSI Z21.80.
 - 3. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
- B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for fuel oil piping system to verify actual locations of piping connections before equipment installation.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

3.3 PIPING APPLICATIONS

- A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.
- B. Fuel Gas Piping, 2 psig or Less:
 - 1. NPS 1/2 to NPS 2: Steel pipe, malleable-iron threaded fittings, and threaded joints.
- C. Containment Conduits: Steel pipe, steel welding fittings, and welded joints.

3.4 VALVE APPLICATIONS

- A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.
- B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.
- C. Appliance Shutoff Valves for Pressure 2 to 5 psig: Gas valve.
- D. Piping Line Valves, NPS 2 and smaller: Gas valve.

3.5 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.
 - 1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
 - 2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
 - a. Exception: Tubing passing through partitions or walls.
 - 3. In Walls: Gas piping with welded joints and protective wrapping specified in Part 2 "Protective Coating" Article may be installed in masonry walls, subject to approval of authorities having jurisdiction.

4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - a. Exception: Accessible above-ceiling space specified above.
 - C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
 - D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.
 - E. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
 - F. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
 - G. Connect branch piping from top or side of horizontal piping.
 - H. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
 - I. Install corrugated, stainless-steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.
 - J. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.
 - K. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.
 - L. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.
- 3.6 JOINT CONSTRUCTION
- A. Basic piping joint construction is specified in Division 23 Section "Basic Mechanical Materials and Methods."
 - B. Use materials suitable for fuel gas.

- C. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 23 Section "Hangers and Supports."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.
- B. Install piping adjacent to appliances to allow service and maintenance.
- C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."
 - 1. Do not use gas pipe as grounding electrode.
- F. Connect wiring according to Division 26 Section "Conductors and Cables."

3.9 PAINTING

- A. Use materials and procedures in painting sections. Exact paint finishes shall be as noted on plans.

3.10 FIELD QUALITY CONTROL

- A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction.
- B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

- C. Verify capacities and pressure ratings of, pressure regulators, valves, and specialties.
- D. Verify correct pressure settings for pressure regulators.
- E. Verify that specified piping tests are complete.

END OF SECTION 231123

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes refrigerant piping used for split system air conditioning unit applications.

1.3 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- B. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
- C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

1.5 COORDINATION

- A. Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

- B. Coordinate pipe sleeve installations for penetrations in exterior walls and floor assemblies. Coordinate with requirements for fire-stopping for materials and methods for sealing pipe penetrations through fire and smoke barriers.
- C. Coordinate pipe fitting pressure classes with products specified in related sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Refrigerant Valves and Specialties:
 - a. Mueller.
 - b. Parker,
 - c. Sporlan.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tube: ASTM B 88, Type L.
- C. Wrought-Copper Fittings: ASME B16.22.
- D. Wrought-Copper Unions: ASME B16.22.
- E. Bronze Filler Metals: AWS A5.8, Classification BAg-1 (silver) or BAg-2 (silver)

2.3 VALVES

- A. Service Valves: 500-psig pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.
- B. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

2.4 REFRIGERANT PIPING SPECIALITIES

- A. Straight- or Angle-Type Strainers: 500-psig working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in liquid lines up to 1-1/8 inches, 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.
- B. Moisture/Liquid Indicators: 500-psig maximum working pressure and 200 deg F operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.
- C. Replaceable-Core Filter-Dryers: 500-psig maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductile-iron cover plate with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:
 - 1. Filter Cartridge: Manufacturer's standard.
- D. Permanent Filter-Dryer: 350-psig maximum operating pressure and 225 deg F maximum operating temperature; steel shell and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.
- E. Mufflers: 500-psig operating pressure, welded-steel construction with fusible plug; sized for refrigeration capacity.

2.5 RECEIVERS

- A. Receivers: ARI 495, UL listed, steel, brazed, 400-psig pressure rating, with tappings for inlet, outlet, and pressure relief valve.

2.6 REFRIGERANTS

- A. ASHRAE 34, R-454B.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Aboveground, within Building: Type L drawn-copper tubing.

3.2 PIPING INSTALLATION

- A. Install refrigerant piping according to ASHRAE 15.
- B. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- D. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- E. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- F. Below ground, install copper tubing in protective conduit. Vent conduit outdoors.
- G. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- H. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- I. Install bypass around moisture-liquid indicators in lines larger than NPS 2.
- J. Install unions to allow removal of solenoid valves, pressure-regulating valves, and expansion valves and at connections to compressors and evaporators.
- K. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.
- L. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports."
- M. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe rollers for multiple horizontal runs 20 feet or longer, supported by a trapeze.
 - 4. Spring hangers to support vertical runs.
- N. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.

O. Support vertical runs at each floor.

3.3 PIPE JOINT CONSTRUCTION

- A. Braze joints according to Division 23 Section "Basic Mechanical Materials and Methods."
- B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

3.4 FIELD QUALITY CONTROL

- A. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.
 1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
 2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
 - a. System shall maintain test pressure at the manifold gage throughout duration of test.
 - b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.
 - c. Fill system with nitrogen to raise a test pressure of 150 psig or higher as required by authorities having jurisdiction.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.5 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of the conditioned air or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 1. Check compressor oil level above center of sight glass.
 2. Open compressor suction and discharge valves.

3. Open refrigerant valves, except bypass valves that are used for other purposes.

3.6 CLEANING

- A. Before installing copper tubing, clean tubing and fittings with trichloroethylene.
- B. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 1. Install core in filter-dryer after leak test but before evacuation.
 2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 2-inch WG. Metal ducts include the following:
 - 1. Rectangular ducts and fittings.
 - 2. Single-wall round spiral-seam ducts and formed fittings.
 - 3. Double-wall round spiral-seam ducts and formed fittings.
 - 4. Duct liner.
- B. Related Sections include the following:
 - 1. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.

1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 QUALITY ASSURANCE

- A. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 DUCT LINER

- A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.
 - 1. Manufacturers:
 - a. CertainTeed Corp.; Insulation Group.
 - b. Johns Manville International, Inc.
 - c. Knauf Fiber Glass GmbH.
 - d. Owens Corning.
 - 2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
 - a. Thickness: 2 inch.
 - b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
 - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
 - 1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
 - 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.

- 3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

B. Flexible Elastomeric Duct Liner: Comply with NFPA 90A or NFPA 90B.

1. Manufacturers:
 - a. Armstrong World Industries, Inc.
2. Materials: Unicellular polyethylene thermal plastic, preformed sheet insulation complying with ASTM C 534, Type II, except for density.
 - a. Thickness: 2 inch.
 - b. Thermal Conductivity (k-Value): 0.24 at 75 deg F mean temperature.
 - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM C 411.
 - d. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

2.3 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
- B. Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.
- C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- E. Solvent-Based Joint and Seam Sealant: One-part, non-sag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
1. Hangers Installed in Corrosive Atmospheres: Electro-galvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
 3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.5 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Nexus Inc.
 - c. Ward Industries, Inc.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
1. Manufacturers:

- a. Ductmate Industries, Inc.
- b. Lockformer.
- 2. Duct Size: Maximum 30 inches wide and up to 2-inch WG pressure class.
- 3. Longitudinal Seams: Pittsburgh lock sealed with non-curing polymer sealant.
- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of non-braced panel area unless ducts are lined.

2.6 APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
- B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
- G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - 1. Fan discharges.
 - 2. Intervals of lined duct preceding unlined duct.
 - 3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.
- I. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell and mylar. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - 1. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

- J. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.7 ROUND DUCT AND FITTING FABRICATION

- A. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Duct Joints:
 - 1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 - 2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 - 3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
 - a. Manufacturers:
 - 1) Ductmate Industries, Inc.
 - 2) Lindab Inc.
- C. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- D. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- E. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
 - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 - 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch WG:
 - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
 - 3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch WG:
 - a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.

4. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
5. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows Larger than 14 Inches in Diameter: Fabricate gored elbows unless space restrictions require mitered elbows.
8. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
10. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch WG: 0.022 inch.

F. Manufacturers:

1. Lindab Inc.
2. McGill AirFlow Corporation.
3. SEMCO Incorporated.

G. Ducts: Fabricate double-wall (insulated) ducts with an outer shell and an inner duct. Dimensions indicated are for inner ducts.

1. Outer Shell: Base metal thickness on outer-shell dimensions. Fabricate outer-shell lengths 2 inches longer than inner duct and insulation and in metal thickness specified for single-wall duct.
2. Insulation: 2-inch- thick fibrous glass, unless otherwise indicated. Terminate insulation where double-wall duct connects to single-wall duct or uninsulated components, and reduce outer shell diameter to inner duct diameter.
 - a. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
3. Solid Inner Ducts: Use the following sheet metal thicknesses and seam construction:
 - a. Ducts 3 to 8 Inches in Diameter: 0.019 inch with standard spiral-seam construction.
 - b. Ducts 9 to 42 Inches in Diameter: 0.019 inch with single-rib spiral-seam construction.
4. Perforated Inner Ducts: Fabricate with 0.028-inch- thick sheet metal having 3/32-inch-diameter perforations, with overall open area of 23 percent.
5. Maintain concentricity of inner duct to outer shell by mechanical means. Prevent dislocation of insulation by mechanical means.

- H. Fittings: Fabricate double-wall (insulated) fittings with an outer shell and an inner duct.
 - 1. Solid Inner Ducts: Use the following sheet metal thicknesses:
 - a. Ducts 3 to 34 Inches in Diameter: 0.028 inch.
 - 2. Perforated Inner Ducts: Fabricate with 0.028-inch- thick sheet metal having 3/32-inch-diameter perforations, with overall open area of 23 percent.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
 - 1. Supply Ducts (Positive Pressure): 2-inch WG.
 - 2. Return Ducts (Negative Pressure): 2-inch WG.
 - 3. Exhaust Ducts (Negative Pressure): 2-inch WG.
- B. All ducts shall be galvanized steel.

3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and fire-stopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories." Fire-stopping materials and installation methods are specified in Section "Through-Penetration Firestop Systems."
- O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."
- P. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in painting sections.

3.3 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
 - 1. For pressure classes lower than 2-inch WG, seal transverse joints.
- B. Seal ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
 - 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 - 2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
 - 3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch WG (both positive and negative pressures). Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

END OF SECTION 233113

SECTION 233300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Fire dampers.
4. Turning vanes.
5. Duct-mounting access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

1.3 SUBMITTALS

- A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Fire dampers.
4. Turning vanes.
5. Duct-mounting access doors.
6. Flexible connectors.
7. Flexible ducts.

- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Fire-damper installations, including sleeves and duct-mounting access doors.
4. Wiring Diagrams: Power, signal, and control wiring.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT DAMPERS

- A. Manufacturers:
 - 1. Air Balance, Inc.
 - 2. American Warming and Ventilating.
 - 3. CESCO Products.
 - 4. Duro Dyne Corp.
 - 5. Greenheck.
 - 6. Penn Ventilation Company, Inc.
 - 7. Prefco Products, Inc.

8. Ruskin Company.
 9. Vent Products Company, Inc.
- B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
- C. Frame: 0.063-inch- thick extruded aluminum, with welded corners and mounting flange.
- D. Blades: 0.025-inch- thick, roll-formed aluminum.
- E. Blade Seals: Neoprene.
- F. Blade Axles: Galvanized steel.
- G. Tie Bars and Brackets: Aluminum.
- H. Return Spring: Adjustable tension.

2.3 VOLUME DAMPERS

- A. Manufacturers:
1. Air Balance, Inc.
 2. American Warming and Ventilating.
 3. Flexmaster U.S.A., Inc.
 4. McGill AirFlow Corporation.
 5. METALAIRE, Inc.
 6. Nailor Industries Inc.
 7. Penn Ventilation Company, Inc.
 8. Ruskin Company.
 9. Vent Products Company, Inc.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
1. Pressure Classes of 3-Inch WG or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
 3. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
 4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
 6. Blade Axles: Galvanized steel.
 7. Bearings: Stainless-steel sleeve.
 8. Tie Bars and Brackets: Aluminum.
 9. Tie Bars and Brackets: Galvanized steel.
- D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
1. Steel Frames: Angle-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
 3. Aluminum Frames: U-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
 4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
 5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
 6. Blade Axles: Galvanized steel.
 7. Bearings: Stainless-steel sleeve thrust or ball.
 8. Blade Seals: Neoprene.
 9. Jamb Seals: Cambered aluminum.
 10. Tie Bars and Brackets: Galvanized steel.
- E. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

- A. Manufacturers:
1. Air Balance, Inc.

2. CESCO Products.
3. Greenheck.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Prefco Products, Inc.
9. Ruskin Company.
10. Vent Products Company, Inc.
11. Ward Industries, Inc.

- B. Fire dampers shall be labeled according to UL 555.
- C. Fire Rating: 1-1/2 hours or as required by wall/floor rating.
- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.052 or 0.138 inch thick as indicated and of length to suit application.
 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Fusible Links: Replaceable, 165 deg F rated.

2.5 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
- B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch O.C.; support with bars perpendicular to blades set 2 inches O.C.; and set into vane runners suitable for duct mounting.
1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Duro Dyne Corp.

- c. METALAIRE, Inc.
 - d. Ward Industries, Inc.
- C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.6 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.
- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
 - 1. Manufacturers:
 - a. American Warming and Ventilating.
 - b. CESCO Products.
 - c. Ductmate Industries, Inc.
 - d. Flexmaster U.S.A., Inc.
 - e. Greenheck.
 - f. McGill AirFlow Corporation.
 - g. Nailor Industries Inc.
 - h. Ventfabrics, Inc.
 - i. Ward Industries, Inc.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Provide number of hinges and locks as follows:
 - a. Less than 12 Inches square: Secure with two sash locks.
 - b. Up to 18 Inches square: Two hinges and two sash locks.
 - c. Up to 24 by 48 inches: Three hinges and two compression latches with outside.
- C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
 - 1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Flexmaster U.S.A., Inc.
 - 2. Frame: Galvanized sheet steel, with spin-in notched frame.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.7 FLEXIBLE CONNECTORS

- A. Manufacturers:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Corp.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

2.8 FLEXIBLE DUCTS

- A. Manufacturers:
 - 1. Flexmaster U.S.A., Inc.
 - 2. Hart & Cooley, Inc.
 - 3. McGill AirFlow Corporation.
- B. Noninsulated-Duct Connectors: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.
 - 1. Pressure Rating: 4-inch WG positive and 0.5-inch WG negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 175 deg F.
- C. Insulated-Duct Connectors: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor barrier film.
 - 1. Pressure Rating: 4-inch WG positive and 0.5-inch WG negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 175 deg F.
- D. Flexible Duct Clamps: Nylon strap, in sizes 3 through 18 inches to suit duct size.

2.9 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- E. Provide balancing dampers at points on supply, return and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Provide test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire dampers, with fusible links, according to manufacturer's UL-approved written instructions.
- H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
 - 1. On both sides of duct coils.
 - 2. Downstream from volume dampers and equipment.
 - 3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
 - 4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
 - 5. On sides of ducts where adequate clearance is available.
- I. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
- J. Install the following sizes for duct-mounting, round access doors:
1. One-Hand or Inspection Access: 8 inches in diameter.
 2. Two-Hand Access: 10 inches in diameter.
 3. Head and Hand Access: 12 inches in diameter.
- K. Label access doors.
- L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- M. For fans developing static pressures of 5-inch WG and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- N. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where indicated and required for testing and balancing purposes.
- 3.2 ADJUSTING
- A. Adjust duct accessories for proper settings.
 - B. Adjust fire dampers for proper action.
 - C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting and Balancing."

END OF SECTION 233300

SECTION 233423 - POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Inline centrifugal ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Greenheck.
 - 2. Loren Cook Company.
 - 3. Twin City Fans.
 - 4. Acme.
- B. Description: In-line, direct-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories:
 - 1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
 - 2. Companion Flanges: For inlet and outlet duct connections.

3. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

2.2 MOTORS

- A. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- C. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch.
- D. Install units with clearances for service and maintenance.
- E. Label units.

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connects to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Adjust damper linkages for proper damper operation.
 - 5. Verify lubrication for bearings and other moving parts.
 - 6. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 7. Shut unit down and reconnect automatic temperature-control operators.
 - 8. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Refer to Division 23 Section "Testing, Adjusting and Balancing" for testing, adjusting and balancing procedures.
- C. Lubricate bearings.

END OF SECTION 233423

SECTION 233713 – DIFFUSERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers and grilles.
- B. Related Sections include the following:
 - 1. Division 23 Section "Duct Accessories" for fire dampers and volume-control dampers not integral to diffusers and grilles.

1.3 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser and Grille Schedule: Indicate Drawing designation, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, speakers, sprinklers, access panels and special moldings.
 - 5. Duct access panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 GRILLES AND REGISTERS

A. As scheduled.

B. Adjustable Bar Diffuser:

1. Products:
 - a. Krueger.
 - b. Metalaire.
 - c. Nailor.
 - d. Price.
 - e. Titus.
 - f. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel, Aluminum.
4. Frame: 1-1/4 inches wide.

C. Fixed Face Grille:

1. Manufacturers:
 - a. Krueger.
 - b. Metalaire.
 - c. Nailor.
 - d. Price.
 - e. Titus.
 - f. Tuttle & Bailey.
2. Material: Aluminum, except in the case of integral fire damper, in which case steel.
3. Finish: Baked enamel, white.
4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
5. Frame: 1-1/4 inches wide.
6. Mounting: Lay in.

2.3 CEILING DIFFUSER OUTLETS

A. As scheduled.

B. Louver Face Diffuser:

1. Manufacturers:
 - a. Krueger.
 - b. Metalaire.

- c. Nailor.
 - d. Price.
 - e. Titus.
 - f. Tuttle & Bailey.
- 2. Material: Steel.
 - 3. Finish: Baked enamel, white.
 - 4. Face Size: 24 X 24 or 12 X 12, as scheduled on plans.
 - 5. Mounting: Surface or T-bar, as scheduled on plans.
 - 6. Pattern: Four-way core style.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers and grilles with airtight connections to ducts and to allow service and maintenance of dampers and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

DIFFUSERS AND GRILLES

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SECTION 234320 - AIR PURIFICATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

1.2 REFERENCED CODES & STANDARDS

- A. The following codes and standards are referenced through out. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.
 - 1. ASHRAE Standards 62 & 52
 - 2. National Electric Code NFPA 70
 - 3. UL 86-2007 including ozone chamber test required as of December 21, 2007
 - 4. The cold plasma equipment and power supply shall be UL and CE listed.
 - 5. The technology shall have been tested to DO-160 by an independent lab and successfully passed all requirements for shock, vibration, EMF and line noise. Manufacturers not tested to DO-160 shall not be acceptable.

1.3 RELATED WORK

- A. Testing, Adjusting and Balancing
- B. Facility Access and Protection
- C. Ductwork
- D. Filters
- E. Water and Refrigerant Piping
- F. Electrical Wiring
- G. Control Wiring

1.4 QUALITY and IP ASSURANCE

- A. Basis of design is Global Plasma Solutions. Active Air Solutions, American Ion, Phenomenal Aire or Plasma Air shall be considered equal subject to meeting all specifications herein. All other manufacturers requesting prior approval must submit product drawings, specifications and test results specified in section 2.2 at least four weeks prior to bid date and shall provide proof they are a licensed manufacturer not infringing upon patent # 9,289,779 B2. Manufacturers not having a license based on patent # 9,289,779 B2 shall not be acceptable.

- B. The Air Purification System shall be a product of an established manufacturer within the USA and shall be made of 100% USA sourced raw materials and components. Ion modules made outside the USA and assembled in the USA on mounting plates shall not be acceptable.
- C. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.
- D. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable. Any system containing titanium dioxide (TiO₂), which has been listed by the CDC as a known carcinogen, shall not be acceptable.
- E. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation performed within the last two years and in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations. The data shall be based on the manufacturer's use of the same make and model number as the equipment submitted on this project.
- F. The Air Purification Technology shall have been tested by UL or Intertek/ETL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. Manufacturers that achieved UL 867 prior to December 21, 2007 and have not been tested in accordance with the newest UL 867 standard with the ozone amendment shall not be acceptable. All manufacturers requesting prior approval shall submit their independent UL 867 test data with ozone results to the engineer for preliminary review and during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.
- G. The maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 0.007 PPM. The maximum peak ozone concentration per the UL 867-2007 peak test as measured 2 inches away from the electronic air cleaner's output shall be no more than 0.0042 PPM. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for ion generators including:

1. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
 2. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.
 3. Performance data for each type of plasma device furnished.
 4. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air Scheduled (when projects are designed with outside air reduction).
 5. Product drawings detailing all physical, electrical and control requirements.
 6. Copy of UL 867 independent ozone test.
 7. Statement on the manufacturer's letterhead stating that the technology contains no titanium dioxide (TiO₂).
- B. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.
- B. Store in original cartons and protect from weather and construction work traffic.
- C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.7 WARRANTY

- A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of eighteen months after shipment or twelve months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished, shall be of the manufacturer specified and shall be self-cleaning.
- B. Basis of Design: Global Plasma Solutions
- C. Alternate acceptable manufacturers: Active Air Solutions, American Ion, Phenomenal Aire, Plasma Air or approved equal.

D. All other Suppliers of comparable products requesting prior approval shall:

1. Submit for prior approval four weeks in advance in accordance with the requirements of Section 230000.
2. In addition, manufacturers submitting for prior approval for Bi-Polar Ionization must as part of the prior approval request provide their ASHRAE 62.1-2007 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third party validation study performed on a previous installation of the same application using the same make and model equipment shall also be included.
3. Submit independent test data from ETL or UL showing ozone levels produced during the UL 867 ozone chamber test. Manufacturers without this test data shall not be acceptable.
4. Submit pathogen testing per section 2.2.
5. Submit at least two other end user references in the same application with contact phone number, email, equipment used and application for the equipment at that facility. Manufacturers not having the above references in similar applications using the same equipment models as proposed on the current project shall not be acceptable.
6. Ionization bars manufactured using DC output ionization modules shall not be permitted due to corrosion, ion short circuiting, intermittent coil coverage and shock hazard.
7. Ionization bars manufactured using ion modules not having epoxy coating all circuit boards and internal components shall not be acceptable.
8. Manufacturers submitting as an alternate shall include their DO-160 test results.
9. It is the responsibility of any alternate manufacturer and mechanical contractor proposing an alternate to the basis of design to confirm any proposed substituted product does not infringe on the patented intellectual property of the basis of design. The engineer and owner recognize the basis of design holds multiple patents and multiple patents are pending.

2.2 BI-POLAR IONIZATION DESIGN & PERFORMANCE CRITERIA

- A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.
- B. The Bi-polar Ionization system shall be capable of:
1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
 2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
 3. Capable of reducing static space charges.
 4. Effectively reducing space particle counts.
 5. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth.

6. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:
 - A. MRSA - >96% in 30 minutes or less
 - B. E.coli - > 99% in 15 minutes or less
 - C. TB - > 69% in 60 minutes or less
 - D. C. diff - >86% in 30 minutes or less
 - E. Noro Virus -> 93.5% in 30 minutes or less
 - F. Legionella -> 99.7% in 30 minutes or less

Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELAC accredited independent lab confirming kill rates and time meeting the minimum requirements stated in section 2.2 B, points 6A, 6B and 6C. Products tested only on Petri dishes to prove kill rates shall not be acceptable. Products being sold under different trade names than those tested shall not be acceptable.
- C. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable. Ionizers with positive and negative output (DC type) shall not be acceptable. All ionizers provided shall be AC type ionizers with one electrode pulsing between positive and negative.
 1. Air exchange rates may vary through the full operating range of a constant Volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
 2. Velocity Profile: The air purification device shall not have maximum velocity profile.
- D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.
- E. Equipment Requirements:
 1. Electrode Specifications (Bi-polar Ionization):
 - a. Each alternating current (AC) Ionization Bar with Bi-polar Ionization output shall include a minimum of sixteen 316 medical grade stainless steel ion needles per foot of coil face width shall be provided. The entire cooling coil width shall have equal distribution of ionization across the face. Systems without ion needles at least 0.75" apart shall not be acceptable. The plasma electrode shall require no more than one inch in the direction of airflow for mounting. All hardware required for mounting shall be provided by the air purification manufacturer except self tapping screws for the power supply. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, and performance

output reduction over time, ozone production and corrosion. Plasma generators and bars with recessed needles shall not be acceptable.

- b. Electrodes shall be energized when the main unit disconnect is turned on.
- c. The ionization output shall be a minimum of 35 million ions/cc per inch of cooling coil width as measured 1 inch from the cold plasma needles.
- d. Ionization bars shall be provided with magnet mounting kits to prevent penetration into cooling coils.

F. Air Handler Mounted Units:

- 1. Where so indicated on the plans and/or schedules Plasma Generator(s) shall be supplied and installed. The mechanical contractor shall mount the Plasma Generator and wire it to the remote mount power supply using the high voltage cables provided by the air purification manufacturer. A 115VAC or 230VAC circuit shall be provided to the plasma generator power supply panel. Each plasma generator shall be designed with an aluminum casing, liquid tight flexible conduit and a high voltage quick connector.

G. Plasma Requirements

- 1. Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above.
 - a. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 115VAC or 230VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.
 - b. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced (AC Ionizers only are acceptable). Imbalanced levels shall not be acceptable.
 - c. Ionization output from each electrode shall be a minimum of 35 million ions/cc when tested at 1" from the ionization generator. The ionization bar shall provide 35 million ions/cc per inch of bar over the entire width of the ionization bar. Bars with needles spaced further apart will not be acceptable.
- 2. Ozone Generation
 - a. The operation of the electrodes or Bi-polar ionization units shall conform to UL 867-2007 with respect to ozone generation.

H. Electrical Requirements:

- 1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 115 VAC or 230VAC, 1 phase, 50/60 Hz.
The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

I. Control Requirements:

1. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset.
2. The ionization system shall be provided with a stand-alone, independent ion sensor designed for duct mounting to monitor the ion output and report to the BAS system that the ion device is working properly. Ion systems provided without an independent ion sensor, shall not be permitted. The control voltage to power the ion sensor shall be 12VDC or 24VAC to 240VAC and draw no more than 150mA of current. The sensor shall provide at minimum, dry contact status to the BAS and optionally a BacNet or Lonworks interface as specified on the control drawings. Manufacturers not providing a stand-alone ion sensor shall not be acceptable.
3. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown on the plans. The contractor shall follow all manufacturer IOM instructions during installation.
4. A fiberglass NEMA 4X panel with Plasma On/Off Indicator Light (interfaced with stand-alone ionization detector), Ionization Output On/Off Indicator Light and an On/Off Illuminated Switch shall be provided to house the power supply.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

3.2 ASSEMBLY & ERECTION: PLASMA GENERATOR

- A. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.
- B. Any material damaged by handling, water or moisture shall be replaced, by the mechanical contractor, at no cost to the owner.
- C. All equipment shall be protected from dust and damage on a daily basis throughout construction.

3.3 TESTING

- A. Provide the manufacturers recommended electrical tests.

3.4 COMMISSIONING & TRAINING

- A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION 234320

SECTION 237413 – PACKAGED UNITARY ROOFTOP UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Packaged commercial gas/electric rooftop HVAC units.

1.2 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures.
- B. Product Data: Submit product data for specified products.
- C. Shop Drawings:
 - 1. Submit shop drawings.
 - 2. Indicate:
 - a. Equipment, piping and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.
 - b. Piping, valves and fittings shipped loose showing final location in assembly.
 - c. Control equipment shipped loose, showing final location in assembly.
 - d. Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.
 - e. Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.
 - f. Fan performance curves.
 - g. Details of vibration isolation.
 - h. Estimate of sound levels to be expected across individual octave bands in dB.
 - i. Type of refrigerant used.
 - j. Plan view, front view end view, back view and curb detail with dimensions.

- D. Quality Assurance:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
 3. Manufacturer's Instructions: Manufacturer's installation instructions.
- E. Manufacturer's Field Reports: Manufacturer's field reports specified.
- F. Closeout Submittals: Submit following:
1. Warranty: Warranty documents specified.
 2. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance. Include names and addresses of spare part suppliers.
 3. Provide brief description of unit, with details of function, operation, control and component service.
 4. Provide equipment inspection report and equipment operation test report.
 5. Commissioning Report: Submit commissioning reports, report forms and schematics.

1.3 QUALITY ASSURANCE

- A. Qualifications:
1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 2. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings).

1.4 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirements.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Packing, Shipping, Handling and Delivery:
1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

2. Ship, handle and unload units according to manufacturer's instructions.

D. Storage and Protection:

1. Store materials protected from exposure to harmful weather conditions.
2. Factory shipping covers to remain in place until installation.

1.5 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
- C. Warranty: Commencing on Date of Installation.
1. Compressors: 5 years (limited).
 2. Other Covered System Components: 1 year (limited).
 3. Stainless Steel Heat Exchangers: 10 years (limited).
 4. Unit Controller 3 years (limited).

PART 2 PRODUCTS

2.1 ROOFTOP UNITS

- A. Manufacturers: Lennox (Basis of Design), Aeon, Daikin, Johnson Controls/York, Trane or prior-approved equal.
- B. Products/Systems to include the following equipment:
1. Cabinet:
 - a. Heavy gauge steel panels.
 - b. Pre-painted steel panels.
 - c. Heavy Gauge galvanized steel base rail.
 - d. Rigging holes on all four corners.
 - e. Forklift slots (on three sides, not directly below condenser coil) on base rail.
 - f. Raised or flanged edges around duct and power entry openings.

- g. Electrical lines and gas lines can be brought through the base of the unit or through horizontal knockouts.
 - h. Insulation:
 - 1) All panels adjacent to conditioned air are fully insulated with foil faced fiberglass insulation.
 - 2) Unit base is fully insulated.
 - 3) Unit base insulation also serves as a roof curb seal.
 - i. Access Panels: Hinged for compressor/controls/heating areas, blower access and air filter/economizer access; and, sealed with quarter-turn latching handles and tight air and water seal.
 - j. Corrosion resistant double sloped condensate Drain Pan.
 - k. Service Valves
2. Cooling System:
- a. Refrigerant type: R-410A.
 - b. Capable of operating from 0 - 125 degrees F (-18 - 52 degrees C) without installation of additional controls.
 - c. Compressors:
 - 1) Scroll Type.
 - 2) Resiliently mounted on rubber mounts for vibration isolation.
 - 3) Overload Protected
 - 4) Internal excessive current and temperature protection
 - 5) Isolated from condenser and evaporator fan air streams
 - 6) Refrigerant cooled
 - d. TXV
 - e. High pressure switch
 - f. Freeze-stat
 - g. High capacity filter driers
 - h. Crankcase heater
 - i. Low pressure switch
3. Coil Construction:
- a. Condensing/evaporator coil general construction:
 - 1) Aluminum Rippled and Lanced fins.
 - 2) Copper tube construction.
 - 3) Aluminum fins mechanically bonded to copper tubes.
 - 4) All coils are high pressure leak tested at manufacturing facility.
 - b. Evaporator Coils:
 - 1) With balanced port thermal expansion valves, freeze protection on each compressor circuit, pressure and leak tested to 500 psi.

- 2) Each compressor circuit on coil divided across face of coil and active through full depth of coil.
4. Wiring:
 - a. Keyed and labeled connections, color coded and continuously marked wire to identify point-to-point component connections.
 - b. Not in contact with hot-gas refrigerant lines or sharp metal edges.
5. Gas Heating System:
 - a. Induced draft
 - b. Natural gas fired system with direct spark ignition
 - c. Electronic flame sensors
 - d. Flame rollout switches
 - e. High heat limit switches
 - f. Induced draft failure switch and capable of operating to altitude of 2000 feet (610 m) with no deration to manifold pressure.
 - g. Service access for controls, burners and heat exchanger
 - h. Heat Exchanger:
 - 1) Tubular Design
 - 2) Stainless steel.
 - i. Gas piping system tight and free of leaks when pressurized to maximum supply pressure.
 - j. Gas Valve: redundant type gas heat valve with manual shutoff
 - k. Two stage gas heating
 - l. Gas Burners: Aluminized steel inshot-type gas burners
 - m. Direct spark pilot ignition
 - n. Fan and Limit Control
 - o. Safety Switches
 - p. Gas piping system tight and free of leaks
6. Heating Controls:
 - a. Support 2 stages of heating control from thermostat or DDC
 - b. With delay time of 30 seconds between low and high heat stages
7. Supply Air Fan Motor and Drives:
 - a. Belt drive
 - b. Permanently lubricated ball bearings (for belt drive motors)
 - c. Thermal overload protected motors with automatic reset
 - d. Adjustable sheaves on belt drive motors for blower speed adjustment
 - e. Optional low and high static motor/drive combinations and optional drive kits

- f. Auto Blower Belt Tensioner
- 8. Supply Air Fan:
 - a. Double inlet type, galvanized steel with forward curved blades
 - b. Statically and dynamically balanced
 - c. Continuous or automatic control for occupied periods
- 9. Supply Air Filters:
 - a. Disposable 2 inch
- 10. Condenser Fan Motor:
 - a. ECM motors on 3-5 ton models. Direct drive with permanently lubricated ball bearings. With the exception of the first sentence, these three items (a, b, c) are not mentioned in the EHB
 - b. Watertight with thermal overload protection and automatic reset
 - c. Motor mount isolated from fan safety guard
- 11. Condenser Fans:
 - a. Corrosion resistant propeller type
- 12. Unit Controller:
 - a. Solid state control board to operate unit
 - b. Scrolling digital display
 - c. Shall provide a 5° F temperature difference between cooling and heating set points to meet ASHRAE 90.1 Energy Standard
 - d. Shall provide and display alarms, alarm history and system status
 - e. Service run test capability
 - f. Shall accept input from a CO2 sensor (both indoor and outdoor)
 - g. Economizer control
 - h. Blower on/off delay
 - i. 2-stage heat/4-stage cool thermostat compatible and warm-up mode
 - j. Diagnostics code storage
 - k. DDC compatible
 - l. Indoor air quality input
 - m. Low ambient controls
 - n. Runtime
 - o. Blower proving switch strike 3
 - p. Real-time clock (timestamps)
 - q. Guided setup
 - r. USB memory stick communication interface
 - s. Controls Options:

1) CO₂ Sensor: Field-mounted

13. Accessories:

- a. Motorized Outside Air Damper: Factory Installed
- b. Dehumidification system with secondary coil: Factory Installed
- c. Smoke detector return: Factory Installed
- d. Roof curb: Field Installed
- e. Hail Guards: Field Installed
- f. Disconnect Switch: Factory Installed
- g. GFCI Service Outlets: Factory Installed (field wired)

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and manufacturer's sheets.

3.2 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions

3.3 INSTALLATION

- A. Install packaged rooftop units in accordance with manufacturer's instructions on roof curbs provided by manufacturer as indicated. Coordinate with architectural roof plan and details.

END OF SECTION 237413

SECTION 238135 – “DUCTLESS” HVAC SPLIT SYSTEM (COOLING-ONLY)

PART 1 – GENERAL

1.1 SYSTEM DESCRIPTION

- A. The variable capacity air conditioning system shall be an Inverter Driven series split system. The basis of design shall be Daikin. Acceptable alternate manufacturers shall be Mitsubishi, LG, Trane or approved equal. The system shall consist of a wall mounted evaporator model exclusively matched to an outdoor model direct expansion (DX), air-cooled, swing, variable speed, inverter driven compressor using R-410A refrigerant of equal and matching nominal tonnage. The outdoor unit is a horizontal discharge, variable speed, single fan unit. The system shall have a self diagnostic function, 3-minute time delay mechanism and have a factory pre-charge of R-410A. The system shall have automatic restart capability after a power failure has occurred and a low voltage cut-off feature to prevent stalling during power supply issues.

1.2 QUALITY ASSURANCE

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
- B. All wiring shall be in accordance with the National Electric Code (NEC).
- C. Each combination shall be rated in accordance with Air Conditioning Refrigeration Institute's (ARI) Standard 210/240 and bear the ARI label.
- D. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
- E. A holding charge of dry nitrogen shall be provided in the evaporator.
- F. System efficiency shall be approximately as scheduled.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendations.

PART 2 – WARRANTY

2.1 LIMITED WARRANTY

The equipment manufacturer shall warrant to the customer who is the original owner and user of the products specified above that under normal use and maintenance for comfort cooling and conditioning applications such products will be free from defects in material or workmanship. This warranty applies to parts only and is limited in duration to two (2) years from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) eighteen (18) months from the date of shipment. Customer must present proof of the original date of receipt and of installation of the Product in order to establish the effective date of this warranty. Otherwise the effective date will be deemed to be the date of manufacture plus sixty (60) days. Repaired or replacement parts are warranted for the balance of the warranty period applicable to the original part following the date on which the repaired or replacement part is provided to the customer.

2.2 EXTENDED WARRANTY

For its compressors only, the equipment manufacturer provides the above warranty (which is applicable to parts only) for a five (5) year period. This extended warranty for compressors is limited in duration to five (5) years from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) eighteen (18) months from the date of shipment, and applies to the compressor and compressor parts only. The effective date of this extended warranty shall be established as above.

2.3 INSTALLATION REQUIREMENTS

The system shall be installed by a factory trained contractor/dealer.

PART 3 – PERFORMANCE

- 3.1 The system performance shall be in accordance with ARI 210/240 test conditions and as scheduled. The cooling performance is based on 80°F DB / 67°F WB for the indoor unit and 95°F DB / 75°F WB for the outdoor unit and 25 feet of piping. The heating performance is based on 70°F DB / 60°F WB for the indoor unit and 47°F DB / 43°F WB for the outdoor unit and 25 feet of piping.
- 3.2 The operating range in cooling will be 14°F DB ~ 115°F DB, and 0°F DB ~ 115°F DB when used with an optional wind baffle.
- 3.3 The operating range in heating will be 5°F DB ~ 64°F WB
- 3.4 The system shall be capable of maximum refrigerant piping of 98 feet, with 66 feet maximum vertical difference, without any oil traps or additional components.

PART 4 – PRODUCTS

4.1 INDOOR UNIT

General:

The indoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. Both liquid and suction lines must be individually insulated between the outdoor and indoor units.

A. Unit Cabinet:

1. The indoor unit shall have a white, "flat screen" finish.
2. The drain and refrigerant piping shall be accessible from six (6) positions for flexible installation (right side, right back, and right bottom; and left side, left back, and left bottom).
3. The cabinet shall be supplied with a mounting plate to be installed onto a wall for securely mounting the cabinet.

B. Fan:

1. The evaporator fan shall be an assembly consisting of a direct-driven fan by a single motor.
2. The fan shall be statically and dynamically balanced and operate on a motor with permanent lubricated bearings.
3. An auto-swing louver for adjustable air flow (vertically) is standard via the wireless remote control furnished with each system.
4. The indoor fan shall offer a choice of five speeds, plus quiet and auto settings.

C. Filter:

1. The return air filter provided will be a mildew proof, removable and washable filter.

D. Coil:

1. The evaporator coil shall be a nonferrous, aluminum fin on copper tube heat exchanger.
2. All tube joints shall be brazed with silver alloy or phoscopper.
3. All coils will be factory pressure tested.
4. A condensate pan shall be provided under the coil with a drain connection.

E. Electrical:

1. The outdoor unit shall be powered with 208-230 volts, 1 phase, and 60 hertz power. The indoor unit shall receive 208-230 volt, 1 phase, 60 hertz power from the outdoor unit.
2. The allowable voltage range shall be 187 volts to 253 volts.

F. Control:

1. The unit shall have a backlit, wireless remote infra-red controller capable to operate the system. It shall have Cooling Operation, Automatic Operation, Dry Operation and Fan Only Operation.
2. The controller shall consist of an On/Off Power switch, Mode Selector, Fan Setting, Swing Louver, On/Off Timer Setting, Temperature Adjustment, °C or °F Temperature Display, and Powerful Operation.
 - i. On/Off switch powers the system on or off.
 - ii. Mode selector shall operate the system in auto, cool, fan or dry operation

- iii. Fan setting shall provide five fan speeds, plus quiet and auto settings.
- iv. Swing louver shall adjust the airflow (horizontal and vertical) blades.
- v. On/Off timer is used for automatically switching the unit on or off.
- vi. Temperature adjustment allows for the increase or decrease of the desired temperature.
- vii. Powerful operation allows quick cool down or heating up in the desired space to achieve maximum desired temperature in the shortest allowable time period.
3. The remote control shall perform Fault Diagnostic functions which may be system related, indoor unit or outdoor unit related depending on the fault code.
4. Temperature range on the remote control shall be 64°F to 90°F in cooling mode and 50°F to 86°F in heating mode.
5. The indoor unit microprocessor has the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote control.

4.2 OUTDOOR UNIT

General:

The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be complete factory assembled and pre-wired with all necessary electronic and refrigerant controls.

A. Unit Cabinet:

1. The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

B. Fan:

1. The fan shall be a direct drive, propeller type fan.
2. The motor shall be inverter driven, permanently lubricated type bearings, inherent.
3. The fan shall be capable of operating in "silent operation" which lowers the outdoor fan speed in either cool, heat or auto modes.
4. A fan guard is provided on the outdoor unit to prevent contact with fan operation.
5. Airflow shall be horizontal discharge.

C. Coil:

1. The outdoor coil shall be nonferrous construction with corrugated fin tube.
2. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.
3. Refrigerant flow from the condenser will be controlled via a metering device.

D. Compressor:

1. The compressor shall be a swing inverter-driven compressor.
2. The outdoor unit shall have an accumulator and four-way reversing valve.
3. The compressor shall have an internal thermal overload.

4. The outdoor unit can operate with a maximum vertical height difference of 66 feet and overall maximum length of 98 feet without any oil traps or additional components.
- E. Electrical:
1. The electrical power requirement is 208-230 volt, 1-phase, and 60 Hz power.
 2. The voltage range limitations shall be a minimum of 187 volts and a maximum of 253 volts.
 3. The outdoor shall be controlled by a microprocessor located in the outdoor and indoor units via commands from the infrared remote controller.

END OF SECTION 238135

SECTION 260000 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE

- A. The electrical portion of this project includes all labor, materials, equipment, etc., required to provide the complete electrical work to fulfill the intent of the Contract Documents.

1.2 RELATED DOCUMENTS

- A. All applicable provisions of Division 0 and 1 govern work under this division. Refer to these articles in the specifications for additional information.
- B. All work shall be in compliance with the currently enforced edition of the applicable state, national, and local ordinance and building codes, and the National Electric Code. No additional compensation shall be granted for work which must be changed as a result of the work not originally complying with the codes and standards. etc.
- C. Refer to each section for additional applicable codes and reference standards.

1.3 FEES, PERMITS AND TAXES

- A. This Contractor is responsible for all inspection fees and permits required by local authorities having jurisdiction. The Contractor is also responsible for all taxes levied for labor and materials associated with the electrical portion of the work. After completion of the work, a certificate of final inspection shall be provided showing approval from the local Electrical Inspector.
- B. This contractor is responsible for any fees, charges or installation costs charged by the local utility for the new electrical service provided.

1.4 SUBMITTALS

- A. Submittals shall be provided for all items indicated. Product data shall be from published manufacturer's data. Data shall include enough information so that the Engineer can verify compliance with codes, standards, and the contract documents. Submittal shall not contain data that is not relevant to the equipment being submitted. The data shall be highlighted by arrows, underlining, etc. broad, general data, is not acceptable. Data shall be presented at one time, in a neatly bound and organized manner.
- B. The contractor shall provide and maintain at the site a set of prints which accurately represent the actual installation of all work under this Division. Any changes in sizes, locations, dimensions,

etc. shall be shown. Changes in circuitry shall be clearly and completely indicated as the work progresses.

- C. At the completion of the Project, a set of marked-up drawings, including DIMENSIONED, location of all underground conduit shall be provided to the owner.

1.5 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

- A. Operating and Maintenance Data includes printed information, such as manufacturer's installation instructions, manufacturer's service manuals, manufacturer's lubrication charts, standard wiring diagrams, and a parts list including the price of each item.
- B. Mark each copy to show applicable choices and options. Where printed Operating and Maintenance Data includes information on several products that are not required, mark copies to indicate the applicable information.
- C. Do not submit Operating and Maintenance Data until compliance with requirements of the Contract Documents has been confirmed.
- D. Submittals: Submit 3 copies of each required submittal. The Engineer will return the copies marked with action taken and corrections or modifications required. Unless resubmittal is requested, the submittal may serve as the final submittal.

1.6 PRIOR APPROVAL

- A. The contractor shall submit a list of proposed substitutions to the Engineer. All proposed substitutions shall be in writing to the Engineer, at least, seven (7) calendar days prior to bid opening. The submittal will list the proposed substitutions from published manufacturer's data, which cover the applicable features of the submitted equipment. Any approvals shall be issued in writing.

1.7 GUARANTEE

- A. The contractor shall fully guarantee the installation against defects in materials and workmanship which may occur under normal usage for a period of one year after owner's acceptance. Defects shall be promptly remedied at no cost to the owner. This guarantee is in addition to, and not a limit to, any other guarantees or warranties.

1.8 DEFINITIONS. The following words and phases are defined:

- A. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in

the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.

- B. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect/Engineer, requested by the Architect/Engineer, and similar phrases.
- C. "Approved": The term "approved," when used in conjunction with the Architect's/Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Architect's/Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- D. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- E. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- F. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- G. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
- H. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform
- I. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- J. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.9 INSPECTION OF THE SITE

- A. The drawings are prepared from the most accurate information available. However, the contractor shall, prior to placing any bids, visit the site to verify existing conditions, proposed conduit routings, etc.

- B. All proposals shall take these existing conditions and any speculated revisions needed into account. The contractor shall be fully responsible for his bid regardless of any additional site information which may be uncovered after a contract is signed.

1.10 CONSTRUCTION SAFETY

- A. The plans and specifications do not include items necessary for the contractor to insure the safety of his personnel on the project construction site. Construction site safety for the project is the responsibility of the contractor. Reference other sections of these specifications for any additional information.

1.11 DAMAGE

- A. The contractor shall be held accountable to repair, at no additional cost, any damage to existing wiring, piping, or other materials and equipment intended to remain.

1.12 DRAWINGS AND SPECIFICATIONS

- A. Should be considered as complimentary to each other. What is required by one shall be binding as if required by both. If conflicts between plans and specifications are found, the Engineer shall be contacted to secure clarification, prior to bidding. The contractor shall verify all dimensions and existing conditions.

1.13 MANUFACTURER'S DRAWINGS AND DATA

- A. Submit Shop Drawings for approval, for all items indicated below.
 - 1. Panelboards
 - 2. Fire Alarm
 - 3. Disconnect Switches
 - 4. Lighting
 - 5. Lighting Contactors
- B. Provide O&M Manuals i.a.w, Paragraph 1.5, for all items indicated below.
 - 1. Fire Alarm
 - 2. Panelboards
 - 3. Lighting Contactors

PART 2 - EXECUTION

2.1 WORKMANSHIP

- A. All work shall be done in a professional and complete manner by experienced craftsmen. Unsatisfactory workmanship shall be duly noted and corrected at the contractors expense.
- B. Only new materials shall be used, unless otherwise indicated on plan or prior approved.

2.2 MANUFACTURER'S INSTALLATION INSTRUCTIONS

- A. All equipment shall be installed in accordance with manufacturer's installation instructions.

2.3 PROTECTION OF EQUIPMENT

- A. The contractor shall provide protection of stored material and installed equipment against dirt, rust, moisture, and abuse from other trades. Where tarps or other cover is used, provide air circulation to prevent condensate build up. No materials or equipment shall be stored directly on the ground.

2.4 CONFLICTS, INTERFERENCES AND COORDINATION BETWEEN TRADES

- A. Coordinate work so as to conform with the progress of the work of others. The drawings are only intended to indicate the extent, general location and arrangement, of conduit systems and equipment. Any questions regarding the information given on the plans shall be directed to the Engineer for clarification. The contractor shall refer to other sections of the specifications and other drawings such as structural, mechanical, etc., in order to eliminate conflicts when laying out his work. The contractor shall be responsible for the proper coordination of the electrical work with the installations under other Divisions for clearances, etc. Any changes required to avoid interferences shall be submitted to the Architect for approval and shall be made, as approved, without additional cost.
- B. Code requirements shall have precedence over plans or specifications in the event of a conflict. If a discrepancy or conflict exists between specifications and drawings, drawings shall take precedence over specifications except as pertaining to quality. Manufacturer's installation instructions shall govern the installation of all equipment.
- C. Control wiring, schematics, or logic shown on plan is only intended to show the general intent. Such plans are not to be considered shop drawings. The contractor is responsible for determining and coordinating the detailed requirements, including but not limited to wiring, to interface systems and provide a fully functional system which follows the intent.
- D. The contractor shall coordinate with equipment suppliers for any requirements specific to the equipment provided which may not be shown on the plans or given in the specifications. The contractor shall include the provision and installation of such requirements in his bid. The contractor shall coordinate with equipment suppliers, prior to bid, to determine what ancillary equipment is or is not provided with the equipment, such as lugs, terminal blocks, etc.

- E. Equipment requiring set grades or elevations and piping has precedence over conduit, boxes, etc. as to location.
- F. The contractor shall coordinate with other equipment providers to insure correct operation of the equipment, such as, phase rotation, interlocking, accessibility, etc.
- G. Low voltage temperature control systems for HVAC systems including controls, relays, time clocks, wiring and devices will be furnished and wired under Division 23. 120Vac wiring required in support of HVAC and other mechanical/plumbing systems shall be furnished and wired under Division 26.
- H. The contractor shall examine the Architectural plans for the location of suitable openings and aisles for the passage of equipment to be installed under this Division. The contractor shall be responsible for having suitable openings and aisles left open until his equipment has been properly installed.
- I. Except as otherwise noted, it shall be understood that the indication and/or description of any item, in the drawings or specifications, or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- J. It shall be understood that the plans are not intended to indicate exact raceway routings. Determination as to the routing shall be made in consideration of structural conditions and interferences with other trades or by terminal locations on apparatus.
- K. The right is reserved to make reasonable changes in locations of equipment indicated in Drawings prior to installation without an increase in the contract cost.
- L. The drawings and specifications do not undertake to indicate every item required to produce a complete and properly operating installation. Material, equipment or labor not indicated, but which can be reasonably inferred to be necessary for a complete installation shall be provided.

2.5 CUTTING AND PATCHING

- A. Every effort shall be made to build-in the work as the job progresses. As required, cutting and patching for the installation of sleeves, conduits, equipment, etc., shall be coordinated with the General Contractor. Do not cut any structural element without written permission from the Structural Engineer.

2.6 EQUIPMENT CONNECTIONS

- A. The contractor shall make final connection of all required services to all equipment items furnished, including that provided by others or by the owner. Equipment shall be left in a ready to operate state.

2.7 FLASHING AND WATERPROOFING

- A. Any building penetrations to outside shall be flashed, as required, to prevent leaks.

END OF SECTION 260000

SECTION 260500 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE

- A. Work of this section includes specification of the following:

Wire and connectors.
Wiring and control devices.
Electrical identification.
Concrete equipment bases.
Firestopping
Demolition
Cutting and patching for electrical construction.
Touchup painting.

1.2 QUALITY ASSURANCE

- A. Provide electrical components, devices, and accessories specified in this section that are UL listed and labeled as defined in NFPA 70, Article 100.
- B. The materials and methods used for all electrical components, devices, and accessories specified in this section shall comply with NFPA 70.

1.3 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
1. Coordinate installation and connection of exterior underground utilities and services, including provision for electricity-metering components.
 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

- D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- E. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.
- F. Verify characteristics, sizes, and ratings, of motors actually supplied prior to providing starter, overload protection and branch circuit wiring.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Wire/Cable
 - a. Anaconda
 - b. American Wire and Cable
 - c. Southwire
 - d. Okonite Company
 - 2. Wire/Cable Connectors
 - Split-Bolt Connectors
 - a. Appleton
 - b. Crouse-Hinds
 - c. Teledyne
 - Solderless Pressure Connectors
 - a. Burndy
 - b. Thomas and Betts
 - c. AMP
 - Spring Wire Connectors
 - a. Burndy
 - b. Thomas and Betts
 - c. Teledyne
 - Compression Connectors
 - a. Burndy
 - b. Crouse-Hinds
 - c. Teledyne
- B. All wire sizes specified shall be i.a.w. American Wire Gauge (AWG) designations.

- C. Conductors, No. 10 awg and smaller shall be solid or stranded copper. Larger than 10 awg shall be stranded copper. Copper clad conductors are not permitted.
- D. Conductors shall be copper with not less than 95% conductivity.
- E. Insulation for power conductors shall be type THW or THHN, rated 600 volts, rated 75 deg. C minimum. Conductor insulation for feeders size 1/0 and larger may be type RHW moisture and heat resistant rubber. Conductor insulation shall have the manufacturers name, type insulation and conductor size imprinted on the jacket at regular intervals. Branch circuit conductors sizes #6 awg and smaller may be type TW. For conductors wired in fluorescent light fixture cable runs use type RHH or THHN insulation rated 90 deg. C.
- F. Conductor phasing shall be as follows. From left to right, the first bus in each panel shall be Phase 'A', middle bus 'B', and right bus 'C'.
- G. Insulation shall be color coded as required by NFPA 70, 210-5. Color coding shall be consistent throughout the project. Use white conductors only for circuit neutrals. When unable to provide a white conductor, the neutral shall be identified at switches, panelboards, junction boxes, etc. with white tape or paint. Equipment grounds shall be green. Isolated equipment grounds shall be green with yellow stripe.
- H. All materials used for wire connections and splices shall be of the size, ampacity, material type, and class suitable for the service.
- I. Provide wire and cable terminations made with UL-listed one-piece, compression deforming type, solderless high conductivity copper or copper alloy terminal lugs as follows:
 - 1. Terminal lugs shall have hole sizes and spacing i.a.w. NEMA standards.
 - 2. Terminal lugs on wire sizes 3/0 and smaller shall be single hole, single compression type. Wire and cable No. 6 awg and smaller may be terminated on mechanical type connections or terminal strips integral with the equipment or wiring device. The mechanical connector and terminal strip shall be UL-listed copper, either tubular type with a pressure plate or screw type with a wire clamp. The screw shall not directly compress the conductors.
 - 3. Terminal lugs for use on wire sizes 4/0 and larger shall be two-hole, long barrel, double compression type.
- J. In general, there shall be no splices from the power source to the load without written approval from the Engineer. If written approval is given, provide splices and taps which are made with solderless copper compression deforming connectors and which bear the UL label. All splices and taps shall be made in accordance with the manufacturer's written instructions.
 - 1. A solid barrel crimped connector shall be used for splices and taps on wire sizes No. 8 AWG and smaller.
 - 2. A solid barrel compression connector or bolting solid barrel terminal lugs shall be used for splices and taps on wire sizes No. 6 AWG and larger.

- K. Connection to motors, solenoids and other devices with integral leads sized No. 4 AWG and smaller (including all current transformers) shall be made with ring-type pressure connectors. Provide connectors bolted together and taped with oil-resistant electrical tape. Soldered or insulation piercing type connectors shall not be used. No connection shall be inside a conduit fitting.

2.2 ELECTRICAL IDENTIFICATION

- A. Underground warning tape shall be a permanent, bright-colored, continuous-printed, vinyl tape with the following features:
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
- B. Wire markers shall be a vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- C. Engraved-Plastic labels, signs, and instruction plates shall be a melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.
- D. Nameplates and signs fasteners shall be self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
- E. The service entrance panelboard shall be labeled "Service Entrance", i.a.w., NFPA 70, Section 230-70(b).
- F. "Danger - 480 Volts" warning signs shall be black lettering on either orange or yellow background. Sign shall be at least 4"x6" and may be either self-adhering or mechanically fastened.

2.3 UTILITY COMPANY METERING

- A. Where required, current-transformer cabinets shall comply with the requirements of electrical power utility company. Meter base is to be furnished by the utility company. Verify all metering requirements with the providing utility prior to bid.

2.4 CONCRETE BASES

- A. All concrete forms and reinforcement materials shall conform to requirements specified in Division 3 Section "Cast-in-Place Concrete."

- B. Concrete used shall have a 3000-psi, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

2.5 TOUCHUP PAINT

- A. Equipment touch-up paint shall be selected to match the installed equipment finish. For galvanized surfaces, a zinc-rich paint recommended by the equipment manufacturer shall be used.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Materials and components shall be installed level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required. Wire and cable routing indicated on the Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- D. Branch circuit wiring is generally sized not to exceed a two-percent voltage drop, but in no case shall exceed a three-percent voltage drop.

3.2 WIRING INSTALLATION

- A. Install wiring in a conduit raceway with conductors of the types and sizes as shown on the drawings and specified in these specifications. Where no type or size is given install conductors as required by code.
- B. From panels extend a complete system of wiring to all fixtures, motors, devices, and other equipment. Employ multi-wire circuits as indicated. Connect circuits to panelboards to give an evenly balanced load. Secure approval for any departure from the circuit arrangement as shown.
- C. Numerals shown on the drawing "home-runs" indicate the circuit arrangement. Cross marks on branch circuit runs indicate the number of conductors required. Where no cross marks are shown, two conductors are indicated.
- D. All home runs shall be 12 (twelve) awg or larger as indicated. Provide 10 (ten) awg where home runs exceed 60 feet in length. No wire smaller than #12 is permitted serving lighting or outlets.

- E. Do not pull conductors until the entire conduit system is complete and the building is 75% dry. Use only UL approved lubricants to facilitate conductor pulling.
- F. Furnish all switches, connections, branch circuits, wiring, etc. to HVAC equipment, as needed, to provide a complete power wiring system. Install and connect 120 Vac control devices which are to be included in power wiring.
- G. Furnish raceway, backboxes, wiring, connections, etc. for all equipment and systems furnished under this or other section(s) of these specifications, or by Owner, for a complete installation i.a.w. suppliers and manufacturers instructions. All equipment shall be connected ready for operation, i.a.w, detailed wiring diagrams furnished by the equipment manufacturer and in cooperation with the respective subcontractor or Owner. Provide receptacles to match equipment furnished plugs.
- H. Install wiring at outlets with a minimum of 8" of slack conductor.
- I. Install pre-finished cord sets where connection with an attachment plug is indicated or specified, or use attachment plug with suitable strain relief clamps.
- J. Solderless pressure connectors with insulating covers shall be used for copper conductor splices and taps, No. 8 awg and smaller.
- K. Insulation on approved splices and taps for wire sizes No. 8 AWG and smaller shall consist of:
 - 1. Half-lapped layers of all weather pvc tape installed to a thickness equivalent to the conductor insulation. Or
 - 2. An insulation system consisting of a heat shrink or cold shrink system properly sized for the application.
- L. Insulation on approved splices and taps for wire sizes No. 6 AWG and larger shall consist of:
 - 1. A minimum of three half-lapped layers of yellow, varnished cambric tape and three half-lapped layers of all weather pvc tape. An electrically insulating putty may be used over irregular shapes prior to application of the tape.
 - 2. An insulation system consisting of a heat shrink or cold shrink system properly sized for the application.

3.3 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

- C. Clean surfaces before applying self-adhesive identification products.
- D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.
- F. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- G. Panel schedules for existing branch circuit panel boards shall be updated for all circuit changes.
- H. All enclosures containing 480 volt circuit conductors shall be clearly labeled with a "Danger - 480 Volts" warning sign.
- I. Label raceway branch circuit junction boxes as to the panel(s) and circuit number(s) from which the circuit(s) originates. Use machine printed, pressure sensitive, abrasion resistant label tape on the faceplate and wiremarkers or tags within the box.
- J. Provide engraved nameplates to identify all electrical distribution and control equipment and loads served. Letter height shall be 1/8 inch for individual switches and loads served, 1/4 inch for distribution and control equipment identification.
- K. Panelboards, switchboards and motor control centers shall have 1/4 inch letter engraved nameplates to identify with the equipment designation, 1/8 inch lettering to identify the voltage rating and source.
- L. Provide an engraved nameplate with 1/8 lettering to identify the conductor color coding scheme at each panelboard and switchboard. Mount on the interior of the door if so equipped, otherwise on the back of the trim.

3.4 UTILITY COMPANY EQUIPMENT

- A. Install equipment according to utility company's requirements. Provide grounding and empty conduits as required by utility company.

3.5 CONCRETE BASES

- A. Construct concrete bases of dimensions specified by the utility company for supporting the distribution transformer. At a minimum, the pad should be not less than 4 inches larger, in both

directions, than supported transformer. Follow transformer or other supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.6 FIRESTOPPING

- A. Penetrations of fire rated floor and wall assemblies shall be sealed with firestop material appropriate to achieve the designated fire resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7.

3.7 DEMOLITION

- A. Remove all existing lighting fixtures, exercising caution to prevent damage, along exterior wall where new construction will be added. All such fixtures shall be made available to the owner. Any items the owner does not want shall be properly disposed of by the contractor.
- B. Remove all existing duplex receptacles along exterior wall where new construction will be added. In receptacle locations not subject to reuse, repair wall and prepare for new finish.
- C. In wall raceway may be capped and abandoned in place. All existing raceway which is run above the ceiling shall be removed and disposed of by the contractor. In wall raceway may be reused where appropriate for the location of a new receptacle outlet.
- D. All demolished materials shall be removed from the project site and disposed of properly.

3.8 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.9 REFINISHING AND TOUCHUP PAINTING

- A. The following procedure should be used for refinishing and/or touch-up needed:
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260500

SECTION 260526 - GROUNDING & BONDING

PART 1 - GENERAL

1.1 SCOPE

- A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.2 RELATED DOCUMENTS

- A. Referenced standards include:

NFPA 70 - National Electric Code

OSHA 1910 - Standards for General Industry

ANSI/IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth
Surface Potentials of a Ground System

1.3 QUALITY ASSURANCE

- A. Provide electrical components, devices, and accessories specified in this section that are UL listed and labeled as defined in NFPA 70, Article 100.
- B. Grounding rod resistance shall be 10 ohms or less.
- C. Grounding system to be tested i.a.w. ANSI/IEEE Std 81 using the "two-point" method.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Rod Electrode
 - a. A.B. Chance
 - b. Copperweld Bimetallics Div
 - c. National Ground Rod
 - 2. Mechanical Connectors
 - a. O.Z. Gedney
 - b. Burndy

- c. Thomas & Betts, Electrical
- 3. Exothermic Connections
 - a. Caldwell
 - b. Thermoweld

2.2 GROUNDING AND BONDING PRODUCTS

- A. Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE AND CABLE GROUNDING CONDUCTORS

- A. Wire and cable grounding conductors shall conform to NEC Table 8, except as otherwise indicated.
- B. All equipment grounding conductors shall be insulated with green color insulation.
- C. Grounding-electrode conductors shall be stranded copper cable.

2.4 MISCELLANEOUS CONDUCTORS

- A. Where required, braided bonding jumpers shall be a copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules. Bonding straps shall be soft copper, 0.05 inch thick and 2 (two) inches wide.

2.5 CONNECTOR PRODUCTS

- A. Pressure type connectors shall be of a high-conductivity-plated design.
- B. Bolted Clamps shall be heavy-duty type.
- C. Exothermic-welded connections shall be as provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.6 GROUNDING ELECTRODES

- A. Grounding rods shall be a copper-clad steel of the size indicated on the drawings.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Equipment grounding conductors shall be installed to comply with NEC Article 250. Where types, sizes, and quantities of equipment grounding conductors, are more than required by NEC use the more stringent requirements.
1. Install insulated equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
 - a. Feeders and branch circuits.
 - b. Lighting circuits.
 - c. Receptacle circuits.
 - d. Flexible raceway runs.
 - e. Armored and metal-clad cable runs.
 - f. Single phase motor or appliance branch circuits.
 - g. Three phase motor or appliance branch circuits.
 2. Install a separate equipment grounding conductor to each electric water heater, heat-tracing assembly, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
 3. Ground metal pole supporting outdoor lighting fixture to a grounding electrode in addition to separate equipment grounding conductor run with supply branch circuit.
- B. Exothermic welded connections shall be used for all underground connections or connections to structural steel
- C. Equipment grounding conductor connections will be made with bolted pressure clamps.
- D. Install an insulated equipment grounding conductor connected to the receptacle grounding terminal for all isolated grounding receptacle circuits. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- E. As noted on the plans, for designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Install an equipment grounding conductor to air duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- G. Provide grounding and installation for telephone equipment i.a.w., NFPA 70, Section 800.

3.2 INSTALLATION

- A. Ground electrical systems and equipment according to NEC requirements, except where

Drawings or Specifications exceed NEC requirements.

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated. Verify that final backfill and compaction has been completed prior to driving ground rods.
 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding conductors shall be routed along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. For underground grounding conductors, use bare copper wire buried at least 24 inches below grade.
- D. Provide 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 by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end. Use braided-type bonding jumpers to electrically bypass water meters.

3.3 CONNECTIONS

- A. Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
- B. Use exothermic-welded connections for connections to structural steel and for underground connections. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment grounding-wire terminations for No. 8 awg and larger, use pressure-type grounding lugs. No. 10 awg and smaller grounding conductors may be terminated with winged pressure-type connectors.
1. Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- D. Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding

bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

- E. Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.
- F. Measure the ground resistance of each rod. A maximum of 10 ohms, unless otherwise indicated, or less to be provided. If ground resistance is not 10 ohms or less, drive additional rods to obtain the required resistance. Paralleled ground rod spacing shall be as recommended in IEEE 142, Grounding of Industrial and Commercial Power Systems.
- G. All test and measurement data shall be provided to the Engineer for review.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Thomas & Betts Corporation.
 - d. Unistrut; Tyco International, Ltd.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
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 in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Hilti Inc.
 - 3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete"
- C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SCOPE

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:
 - a. EMT - Electrical Metallic Tubing
 - b. FMC - Flexible Metal Conduit
 - c. LFMC - Liquid Tight Flexible Metal Conduit
 - d. PVC - PVC coated, Rigid Steel Conduit
 - e. RNC - Rigid Non-metallic Conduit
 - f. RSG - Rigid Steel Galvanized Conduit
2. Boxes, enclosures, and cabinets include the following:
 - a. Device boxes.
 - b. Floor boxes.
 - c. Outlet boxes.
 - d. Pull and junction boxes.
 - e. Cabinets and hinged-cover enclosures.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Sections, apply to this section.

- B. Referenced standards include:

NFPA 70 - National Electric Code
ANSI C80.1 - American National Standard, Rigid Steel Galvanized Conduit
ANSI C80.3 - American National Standard, Electrical Metallic Tubing
OSHA 1910 - Standards for General Industry
NEMA FB1 - National Electrical Manufacturers Assoc., fittings
NEMA TC 3 - PVC fittings

1.3 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.
- B. Field verify measurements.

- C. Verify routing and termination locations of conduit prior to rough-in.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Metal Conduit and Tubing:
 - a. Allied Tube and Conduit
 - b. Triangle
 - c. Wheatland
 - d. Anaconda (flexible conduit)
 2. Nonmetallic Conduit and Tubing:
 - a. Carlon
 - b. Robroy
 - c. Anaconda
 3. Conduit Bodies and Fittings:
 - a. Crouse-Hinds
 - b. Appleton
 - c. O-Z/Gedney
 4. Fire Rated Fittings:
 - a. Crouse-Hinds
 - b. O-Z/Gedney
 - c. Appleton
 5. Expansion/Deflection Fittings:
 - a. Crouse-Hinds
 - b. O-Z/Gedney
 - c. Appleton
 6. Cable Trough/Wireway
 - a. B-Line
 - b. Wiremold
 - c. Hoffman
 - d. Hammond
 7. Boxes, Enclosures, and Cabinets:
 - a. Crouse-Hinds
 - b. Hoffman
 - c. B-Line

d. Robroy

2.2 METAL CONDUIT AND TUBING

A. EMT and Fittings

1. All electrical metallic tubing shall comply with the latest revision of ANSI C80.3.
2. Electrical metallic tubing (EMT) shall be galvanized steel and shall be used for all indoor concealed or exposed work, unless otherwise noted. Connectors and couplings shall be threadless compression type.

B. FMC

1. Flexible metal conduit shall be used for final connections to motors. Conduit shall be of an interlocked steel construction.

C. LFMC

1. Liquid tight flexible metal conduit shall be used in wet locations for final connections to motors and other equipment subject to vibration. Preference given to neoprene jacketed Seal-tite by Anaconda or equal.

D. PVC

1. PVC coated rigid steel conduit shall be used for all transitions from below grade to 18 (eighteen) inches above the finished grade or floor.

E. RSG

1. All rigid steel galvanized conduit shall comply with the latest revision of ANSI C80.1.
2. Rigid steel galvanized conduit shall be used for all exterior exposed work, unless otherwise noted. Rigid steel galvanized conduit shall be used in all NEC, classified, hazardous locations whether interior or exterior.

F. Fittings

1. All fittings shall comply with the requirements of NEMA FB 1, standard for conduit fittings, cast metal boxes, and conduit bodies. All fittings used shall be compatible with the conduit and tubing materials used.

2.3 NONMETALLIC CONDUIT

A. RNC

1. Unless otherwise noted, all rigid nonmetallic conduit shall be schedule 40 PVC complying with NEMA TC 3 standards.
2. RNC shall be used for underground cable runs, unless otherwise noted. Provide schedule 80 PVC where underneath roadways and drives subject to vehicle traffic.

B. Fittings

1. Unless otherwise noted, all fittings used with nonmetallic conduit shall be schedule 40 PVC complying with NEMA TC 3 standards. The fittings used shall be compatible with conduit size and type.

2.4 OUTLET AND DEVICE BOXES

A. Metal Boxes

1. Provide galvanized steel metal boxes sized to accommodate devices and conductors as per NEC Art. 370 at each outlet location indicated on the drawings or as required. Boxes shall be a minimum of 1.5" deep, of metal a minimum of 1/16" thick.
2. Boxes used with exposed conduit should be a four-inch square utility box.
3. The owner reserves the right to make adjustments to the location of outlet boxes prior to rough-in.
4. Sizes and configuration of boxes shall be as required for the intended service. The boxes shall conform to and be applied, i.a.w, NEC requirements. Supports, gaskets, extension rings, etc. shall be provided where required.
5. Gang type boxes shall be used where multiple wiring devices are located together.

B. Floor Boxes

1. Floor boxes shall be located as indicated on the drawings. Coordinate with architect/owner prior to final placement. A multi-function floor box, providing completely segregated power and data cabling and outlets, shall be used where power and communications outlets are shown in the same general location, even when the outlets are shown on different electrical plan sheets.
2. Nonmetallic boxes suitable for concrete encasement may be used.
3. Boxes shall be completely flush with the ground when the lid is closed.

4. Floor boxes shall be equal to Legrand model EFB45S or Hubbell CFB E-Series.

2.5 CABLE TROUGH/WIREWAY

- A. The contractor shall furnish a complete wireway/trough system in accordance with the requirements as specified on the plan drawings.
- B. The wireway shall be NEMA 3R, 14 or 16 gauge galvanized steel, provided with removable covers.
- C. All wireways shall be provided with dividers, as needed to maintain cable separation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 1/2-inch trade size. Homeruns shall be 3/4" minimum.
- C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, CMU walls, ceilings, and floors, except in equipment room. Do not run conduit in **cavity** of exterior wall with brick exteriors.
- D. Keep raceways at least 12 inches away from hot-water pipes. Install horizontal raceway runs above water piping.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.
- G. All conduits, concealed or exposed, shall be supported and substantially fastened to structural members at intervals of not more than 8 (eight) feet. Attach supporting devices with screws, bolts, expansion sleeves or other workmanlike means appropriate to the surface. Boxes which are not embedded in masonry or concrete shall be fastened to the structure in the same manner as for conduits.
- H. Use temporary closures to prevent foreign matter from entering raceways.

- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab. Where conduits emerge from the ground or slab, provide a rigid steel adapter, elbow and conduit. Slope conduits to drain away from the building. All metal conduits installed underground shall be PVC coated. PVC coated rigid steel conduit shall be used within five feet from foundation walls.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- K. Use raceway fittings compatible with raceways and suitable for use and location.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Transition from nonmetallic tubing to rigid steel conduit before rising above floor.
- N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
 - 1. Run parallel or banded raceways together, on common supports where practical.
 - 2. Make bends in parallel or banded runs from same centerline. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- O. Join raceways with fittings designed and approved for the purpose and make joints tight.
 - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - 2. Use insulating bushings to protect conductors.
- P. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box. Provide bushings on ends where auxiliary system conduit raceway is stubbed out into furred space, adjacent to backboard, etc.
- Q. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

- R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.
- S. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- T. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
- U. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- V. Set floor boxes level and trim after installation to fit flush to finished floor surface.
- W. Provide galvanized sheet metal pull boxes with screw type cover, as required, to avoid excessive runs or bends between outlets.
- X. Grade all raceway away from service entrance equipment to prevent water damage.
- Y. Provide expansion fittings in all conduits crossing an expansion joint. Fitting shall be OZ type EX for rigid metal conduit or schedule 40 pvc. Fitting shall be OZ type TX for EMT. Metallic conduit not containing a grounding conductor shall have OZ type BJ bonding jumpers installed across expansion joints. Provide expansion fittings for PVC conduit runs over 150 feet, or outdoors or in areas or runs subject to temperature variations over 75 degrees F, and as recommended by the manufacturer.
- Z. Grouped raceways shall be supported with galvanized steel channel assemblies equal to Kindorf B-909 and single bolt straps equal to Kindorf C-105. Raceway supports shall be spaced within 2 (two) feet of termination and/or connection and 8 (eight) feet on center for rigid steel, and EMT conduit. RNC shall be supported i.a.w. NFPA 70, 347-8. FNMC shall be supported within 12 (twelve) inches of termination/connection and 4.5 (four and one-half) feet on center.
- AA. The drawings indicate approximate locations only. Determine the exact location on site in consideration of all structural and architectural conditions.

- BB. Provide and install low point drains in all above grade, outdoor raceway. Provide and install breather drains in the bottom of outdoor control panels. As much as possible, route conduits into the bottom of control panels.
- CC. All phase conductors and, where used, the grounded conductor, and all equipment grounding conductors shall be grouped together in a single raceway. Where multiple phase conductors are run in parallel, separate conduits shall be run to contain one set of all phase conductors, neutral (if used) and the equipment grounding conductor.
- DD. Where underground conduits stub-up through concrete equipment pad “blocked out” windows, after curing blocks, fill the block-out window with gravel to 1” of the top and cap with mortar. Caulk all entrances and around the mortar.

3.3 PROTECTION

- A. Provide final protection and maintain conditions, in a manner that ensures coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 260533

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. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- C. Comply with ANSI Z535.4 for safety signs and labels.
- D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type ID:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. 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 identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.
- G. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - a. Color shall be factory applied.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

- H. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels Baked-enamel warning signs.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be **engraved**, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.

- c. Access doors and panels for concealed electrical items.
- d. Switchboards.
- e. Enclosed switches.
- f. Contactors.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:

1. Time switches.
2. Photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.

1.2 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
1. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: UL listed and labeled as defined in NFPA 70, Article 100, and marked for intended use.

1.5 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Grasslin Controls Corporation; a GE Industrial Systems Company.
 2. Intermatic, Inc.
 3. Leviton Mfg. Company Inc.
 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 5. Paragon Electric Co.; Invensys Climate Controls.
 6. Square D; Schneider Electric.
 7. TORK.
- B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
1. Contact Configuration: DPDT
 2. Contact Rating: 30-A inductive or resistive, 240-V ac or as otherwise noted on the plans.
 3. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
 4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
 5. Astronomic Time: All channels.
 6. Battery Backup: For schedules and time clock.
- C. Electromechanical-Dial Time Switches: Type complying with UL 917.
1. Contact Configuration: DPDT
 2. Contact Rating: 30-A inductive or resistive, 240-V ac or as otherwise noted on the plans.
 3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
 4. Astronomic time dial.
 5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
 6. Skip-a-day mode.
 7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Area Lighting Research, Inc.; Tyco Electronics.
 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
 3. Intermatic, Inc.
 4. Lithonia Lighting; Acuity Lighting Group, Inc.

5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.

B. Description: Solid state, with DPST dry contacts rated to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR OCCUPANCY SENSORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. Sensor Switch, Inc.
6. TORK.

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.
- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.4 LIGHTING CONTACTORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allen-Bradley/Rockwell Automation.
 - 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
 - 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 4. GE Industrial Systems; Total Lighting Control.
 - 5. Hubbell Lighting.
 - 6. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 7. Square D; Schneider Electric.
- B. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- B. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

- C. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring.
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 260923

SECTION 262200 - DRY-TYPE TRANSFORMERS (1000 V and Less)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes dry-type distribution and specialty transformers rated 1000 V and less.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Referenced Standards include:
 - NFPA 70 - National Electric Code
 - OSHA 1910 - Standards for General Industry

1.3 SUBMITTALS

- A. Submit product data on features, components, ratings, and performance for each type of transformer specified. Include dimensioned plans, sections, and elevation views. Show minimum clearances and installed devices and features.
- B. Submit shop drawings which detail wiring and identify terminals for tap changing and connecting field-installed wiring.
- C. Provide a product certificate signed by the transformer manufacturer certifying that the products furnished comply with requirements.

1.4 QUALITY ASSURANCE

- A. Provide transformers specified in this Section that are listed and labeled as defined in NFPA 70, Article 100.
- B. As defined in OSHA Regulation 1910.7, the Listing and Labeling Agency shall be a "Nationally Recognized Testing Laboratory".

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

DRY-TYPE TRANSFORMERS (1000 V and Less)

262200-1

- A. Acceptable manufacturers: Subject to compliance with requirements, manufacturers offering transformers that may be incorporated into the Work include, but are not limited to, the following:
1. Cutler-Hammer
 2. General Electric
 3. Square D
 4. Siemens

2.2 TRANSFORMERS, GENERAL

- A. Transformers shall be factory-assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.
- B. Transformer cores shall be grain-oriented, nonaging silicon steel.
- C. The transformer coils shall have continuous windings without splices, except for taps.
- D. The transformer internal coil connections shall be either brazed or pressure type.
- E. The transformer enclosure shall be suitable for the environment in which it is installed.

2.3 GENERAL-PURPOSE DISTRIBUTION AND POWER TRANSFORMERS

- A. Transformer cores shall have one leg per phase with one coil in the primary and secondary.
- B. The transformer enclosure shall be an indoor, ventilated unit.
- C. The transformer winding insulation shall be a minimum 185 deg C class for transformers larger than 15 kVA with a rated temperature rise of 115 deg C maximum above a 40 deg C ambient.
- D. The transformer shall have provision for at least two 2.5 percent taps above and four 2.5 percent taps below the rated high voltage.
- E. Where indicated as "low-noise", the transformer shall have a maximum audible sound level 5dB below the NEMA ST-20 limits.
- F. Where required as indicated on the plans, the transformer shall have a minimum K-Factor rating of 4. The transformers shall comply with UL 1561 requirements for nonsinusoidal load current handling capability to the degree defined by the designated K-factor.
1. Transformer design prevents overheating when carrying full load with harmonic content corresponding to the designated K-factor.
 2. Nameplate states the designated K-factor of the transformer.

2.4 FINISHES

- A. The transformer shall have an exterior finish consisting of the manufacturer's standard paint over corrosion-resistant pretreatment and primer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Arrange the transformer to provide adequate spacing for access and for circulation of cooling air in accordance with the manufacturer's installation instructions.
- B. Identify transformers and install warning signs according to Section 16050.
- C. 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.
- D. Install in accordance with manufacturer's written instructions for maximum attenuation of transformer noise.

3.2 GROUNDING

- A. The transformer shall be grounded in accordance with the requirements of NFPA 70 and the applicable requirements of Section 260526.

3.3 TESTING

- A. Include the following minimum inspections and tests according to manufacturer's written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.
 - 1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
 - 2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.
 - 3. Insulation Resistance: Perform megohmmeter tests of primary and secondary winding to winding and winding to ground.
 - a. Minimum Test Voltage: 1000 V, dc.
 - b. Minimum Insulation Resistance: 500 megohms.
 - c. Duration of Each Test: 10 minutes.
 - d. Temperature Correction: Correct results for test temperature deviation from 20 deg C standard.
- B. Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements. Test results shall be provided to Owner and Engineer.

3.4 CLEANING

- A. On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.5 ADJUSTING

- A. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility.

END OF SECTION 262200

SECTION 262416 - PANELBOARD

PART 1 - GENERAL

1.1 SCOPE

1. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V and less for the following types:

Lighting and appliance branch - circuit panelboards
Distribution panelboards

1.2 SUBMITTALS

1. Submit product data for each type of panelboard, accessory item, and component specified.
2. Submit shop drawings for panelboards. Include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:
 1. Enclosure type with details.
 2. Bus configuration and current ratings.
 3. Short-circuit current rating of panelboard.
 4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
 5. Wiring Diagrams: Details of schematic diagram including control wiring and differentiating between manufacturer-installed and field-installed wiring.
3. Submit panelboard schedules for installed panelboards after load balancing.

1.3 QUALITY ASSURANCE

1. Provide products specified in this Section that are UL listed and labeled as defined in NFPA 70, Article 100.
2. Acceptable manufacturers shall be companies regularly engaged in the design, manufacture, and testing of panelboards for electrical use and shall have been producing such products for at least five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Acceptable manufacturers: Subject to compliance with requirements, manufacturers offering

products that may be incorporated into the Work include, but are not limited to, the following:

1. Cutler-Hammer
2. General Electric
3. Square D

2.2 PANELBOARD FABRICATION

1. Enclosures: Flush- and surface-mounted cabinets.
 - 1) Rated for environmental conditions at installed location.
 - a) Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b) Outdoor Locations: NEMA 250, Type 3R.
 - c) Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - d) Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2) Front: Dead 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) Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 5) Finishes:
 - a) Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b) Back Boxes: Steel. Same finish as panels and trim.
2. The directory frame shall be metal with a transparent protective cover, mounted inside each panelboard door.
3. The panelboard bus shall be hard drawn copper of 98 percent conductivity with compression type main and neutral lugs. Panelboard shall have a full-capacity neutral bus.
4. The equipment ground bus will be adequate for feeder and branch-circuit equipment ground conductors and be bonded to the box.
5. Unless otherwise noted or indicated on the drawings, only panelboards listed as approved for service entrance equipment use with a main disconnect shall be used as a service entrance panel.
6. Minimum rating of panelboards shall be 10,000 AIC rms sym. Refer to the drawings for higher rating requirements. Refer to the drawings for panel bus ratings.
7. Panelboards shall have provisions for at least the number of branch-circuits as indicated on the drawing panel schedules. Circuits will be filled with circuit breakers, at least, as indicated on the

panel schedule.

8. The panelboard box shall be fabricated of code gauge, galvanized sheet steel i.a.w. UL standards. The box shall have standard knockouts on the enclosure.
9. The front shall be fabricated of sheet steel and finished with a baked on gray enamel over a rust inhibitor. Panelboards shall have a full hinged cover. Doors shall have flush type cylinder locks and catches. Panelboard locks shall be master keyed, with two keys furnished for each panelboard.
10. Incoming mains location: Top and bottom.
11. Conductor Connectors: Suitable for use with conductor material and sizes.
 - (i) Material: Hard-drawn copper, 98 percent conductivity.
 - (ii) Main and Neutral Lugs: Compression type.
 - (iii) Ground Lugs and Bus-Configured Terminators: Compression type.
 - (iv) Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - (v) Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - (vi) Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

2.3 CIRCUIT BREAKERS

1. Circuit breakers shall be bolt-on type full module, with quick-make and quick-break toggle action mechanism. Trip indication shall be shown by breaker handle taking position between on and off. All multiple pole services shall be common trip with a single handle. Circuit breakers shall be replaceable without disturbing adjacent units.
2. Circuit breakers shall be fully rated with an interrupting rating equal to that of the panelboard to which they are installed.
3. Circuit breakers will be of the same manufacturer as the panelboard installed.
4. Circuit breakers shall have mechanical compression connections.
5. Single pole circuit breakers serving fluorescent lighting loads shall have the SWD marking.
6. Circuit breakers serving air conditioning branch loads shall be UL listed as HACR type.
7. All circuit breakers shall be of the same manufacturer as the panelboard to which they are installed.

PART 3 - EXECUTION

3.1 INSTALLATION

1. Panelboards shall be installed at 72 inches above finished floor to the top of the trim, unless otherwise indicated.
2. Panelboards shall be mounted plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.
3. Type the circuit directory to indicate installed circuit loads after balancing panelboard loads. Install the typed directory in the panelboard.
4. Install filler plates in unused spaces.
5. Wiring shall be neatly arranged in panelboard gutters.
6. For flush mount panelboards, stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
7. Set field-adjustable circuit breaker trip ranges.

3.2 IDENTIFICATION

1. Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.

3.3 GROUNDING

1. Make equipment grounding connections for panelboards as indicated, i.e., NEC. Provide ground continuity to main electrical ground bus.

3.4 CONNECTIONS

1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 TESTING

1. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.

Panelboard bus insulation tests shall consist of a 1000 volt "megger" test, phase-to-phase and each phase-to-ground, each test shall be held for a minimum of one minute. Minimum acceptable insulation resistance shall be 500 megohms. Test results shall be corrected for temperature deviations from a 20 deg C standard. Provide test results to Owner and Engineer.

2. Make continuity tests of each circuit.
3. Measure steady-state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase load within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE

- A. Work of this section includes specification of the following:
 - 1. Receptacles
 - 2. Switches
 - 3. Wall Plates

1.2 SUBMITTALS

- A. Submit product data on the switches, receptacles, and wall plates to be used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Wiring Devices:
 - a. Arrow
 - b. Hubbell
 - c. Leviton

2.2 RECEPTACLES

- A. Receptacles shall be specification grade, duplex type, rated 20 amp, 120 volt service, unless otherwise noted. Receptacles shall be of the straight-blade design, NEMA configuration 5-20R. Receptacles of critical branch circuits shall be red.

Hubbell 5351, Arrow-Hart 5351, or Leviton 5351: 125 V single convenience receptacle
Hubbell 5352, Arrow-Hart 5352, or Leviton 5352: 125 V duplex convenience receptacle

- B. GFCI receptacles may be a feed-through, as needed to protect downstream receptacles on the same circuit. The duplex receptacle configuration shall be NEMA 5-20R. Weatherproof enclosures shall be provided as indicated on the drawings. Receptacle shall have an integral ground fault circuit interrupter.

Hubbell GF5362, Arrow-Hart GF5342, or Leviton 6899: 125 V GFCI duplex receptacle.

- C. All receptacles shall have plaster ears and grounding straps.

- D. Unless otherwise noted by Owner and/or Architect, all receptacles shall be ivory in color with stainless steel cover plate. Each like receptacle on the project shall be of the same manufacturer and catalog number.

2.3 SWITCHES

- A. All toggle switches will be specification grade, quiet type snap switches, rated for 20 amp, 120/277 volt service. At a minimum, side screw terminals shall be provided.

Hubbell HBL1221, Arrow-Hart 1991, Leviton 1221: Single pole toggle switch.

Hubbell HBL1222, Arrow-Hart 1992, Leviton 1222: Double pole toggle switch.

Hubbell HBL1223, Arrow-Hart 1993, Leviton 1223: Three-way toggle switch.

Hubbell HBL1224, Arrow-Hart 1994, Leviton 1224: Four-way toggle switch.

- B. Unless otherwise noted by Owner and/or Architect, all switches shall be ivory in color with stainless steel cover plate. Each like switch on the project shall be of the same manufacturer and catalog number.
- C. Fluorescent dimmer switches shall be compatible with dimmer ballast. Dimmer/Ballast combination shall be capable of consistent dimming down to no more than 5% of full brightness.

2.4 WALL PLATES

- A. Single, gang, and combination type wall plates will be used as needed with each corresponding wiring device.
- B. Each wall plate will be of a matching color to the wiring device attached. The plate will be secured with metal, matching color headed screws. Provide stainless steel plate unless otherwise noted by Owner and/or Architect.
- C. Where weatherproof devices are noted, provide IN-USE type with clear cover. Equal to Pass & Seymour WIUC10-CL (for single gang applications)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all wiring devices and assemblies plumb and secure.
- B. Install all wall plates when painting is complete.
- C. Install all wiring devices by connection to screw terminals only. Connection to pressure terminals is not acceptable.

- D. Use single plates of proper gang where more than one device occurs. Furnish blank plates on outlets for future use.
- E. Unless otherwise noted, install wall devices vertically so that all devices of any given height will exactly align. Plates must be plumb and true with all four edges in continuous contact with the wall surface. Do not install devices until plastering or other wall covering work is complete.
- F. Protect wiring devices during painting.
- G. Wiring devices and other equipment shall, unless otherwise noted, be mounted with respect to indicated surfaces as follows: Note – verify all device mounting heights with Architect prior to rough-in. Architectural/ADA requirements take precedence over that given here in the event of any discrepancies.

Receptacles:	18" AFF or 6" above working surface
Switches:	48" AFF or as otherwise required for ADA compliance
Telephone outlets:	same as receptacles
Computer network outlets:	same as receptacles
Thermostats:	48" AFF or as otherwise required for ADA compliance

All dimensions to centerline of the device box.

- H. Wiring device grounding terminals shall be connected to the branch-circuit equipment grounding conductor.
- I. GFCI receptacles will be functionally tested according to the manufacturers instructions. Record of the test shall be provided to the owner.
- J. All emergency system receptacles shall be marked as to the panelboard and circuit number from which it originates.
- K. Install all switches with the "OFF" position down.
- L. Install receptacles with grounding pole on top.
- M. Coordinate exact location of all wiring devices with owner/architect prior to rough-in.

END OF SECTION 262726

SECTION 262816 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE

- A. This Section includes individually mounted switches used as an equipment disconnect.

1.2 RELATED DOCUMENTS

- A. Referenced standards include:

NFPA 70 - National Electric Code

OSHA 1910 - Standards for General Industry

ANSI/UL 198C - High-Intensity Capacity Fuses: Current Limiting Types

ANSI/UL 198E - Class R Fuses

1.3 SUBMITTALS

- A. Submit product data and shop drawings for the fused disconnect specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering disconnect switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:

- 1. Molded Case Circuit Breaker:

- a. General Electric
- b. Square D
- c. Cutler-Hammer
- d. Siemens

- 2. Fusible Switches:

- a. General Electric
- b. Square D
- c. Cutler-Hammer
- d. Siemens

2.2 DISCONNECT SWITCHES

- A. Fusible Switch Assemblies: Switch shall be heavy-duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. The handle shall be lockable and interlocked with the cover in the CLOSED position to prevent opening with the switch in the ON position. Fuse clips shall be designed to accept Class R fuses.
- B. Non-fusible Switch Assemblies: Switch shall be heavy-duty, quick-make, quick-break load interrupter enclosed knife switch with externally operable handle. The handle shall be lockable and interlocked with the cover in the CLOSED position to prevent opening with the switch in the ON position.
- C. Operation of the handle shall disconnect all three poles.

2.3 FUSES

- A. Fuses 600 amps and less shall be ANSI/UL 198E, Class RK1, RK5, size as indicated, dual element, current limiting, time delay.
- B. Interrupting rating shall be 200,000 amps rms symmetrical.
- C. Acceptable manufacturers: Bussman, Gould, Reliance Co.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The location indicated for each disconnect is approximate. Coordinate with the protected equipment's installer for the exact location. Install i.a.w. manufacturer's written instructions.
- B. Install disconnect switches level and plumb.
- C. Install all wiring between disconnect switches, and equipment so as to make a complete and functional installation.
- D. Provide grounding i.a.w. NEC requirements.
- E. Label the disconnect with the distribution panel name and circuit number feeding the switch. Labeling shall comply with the applicable requirements of Section 260500.

END OF SECTION 262816

DISCONNECT SWITCHES

262816 -2

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 - a. 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.

1.4 QUALITY ASSURANCE

- A. Provide luminaires from a single manufacturer for each luminaire type.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five years 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. Recessed Fixtures: Comply with NEMA LE 4.
- C. CRI of minimum 80 CCT of 3500 K.
- D. Rated L70 life of 50,000 hours for the entire fixture assembly, including driver.
- E. Lamps dimmable from 100 percent to 1 percent of maximum light output.
- F. Internal driver.

2.2 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. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. 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.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.

3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- D. 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 for all luminaires.

2.3 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.

2.4 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm)
- C. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- D. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- G. Suspended Luminaire Support:
 - 1. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 2. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
 - 3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
 - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 265619 – LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Exterior solid state luminaires that are designed for and exclusively use LED lamp technology.
 - 2. Luminaire-mounted photoelectric relays.
 - 3. Poles and accessories.
- B. Related Sections include the following:
 - 1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.2 DEFINITIONS

- A. CRI: Color-rendering index.
- B. CCT: Correlated color temperature
- C. Luminaire: Complete lighting fixture, including ballast housing if provided.
- D. Pole: Luminaire support structure, including tower used for large area illumination.
- E. Standard: Same definition as "Pole" above.
- F. Lumen: Measured output of lamp and luminaire, or both.

1.3 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.
- B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4.
- C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4.
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
 - 1. Wind speed for calculating wind load for poles 50 feet or less in height is 110 mph.

1.4 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - 6. Photoelectric relays.
 - 7. Ballasts, including energy-efficiency data.
 - 8. Lamps, including life, output, and energy-efficiency data.
 - 9. Materials, dimensions, and finishes of poles.
 - 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 - 11. Anchor bolts for poles.
 - 12. Manufactured pole foundations.
- B. Shop Drawings:
 - 1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
- C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- D. Field quality-control test reports.
- E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: UL listed and labeled as defined in NFPA 70, Article 100, and marked for intended use.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
 - 4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion.
 - 5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Ballasts: 1 for every 10 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Lighting Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be UL listed and labeled for installation in wet locations.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

- F. 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. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- N. CRI of minimum 70. CCT of 4000 K
- O. L70 lamp life of 50,000hours.
- P. Internal driver.
- Q. Nominal Operating Voltage: 120 V ac
- R. Lamp Rating: Lamp marked for outdoor use
- S. Source Limitations: Obtain luminaires from single source from a single manufacturer.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.

- B. Fasten luminaire to indicated structural supports.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.2 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top 6 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 3 Section "Cast-in-Place Concrete."

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 16 Section "Raceways and Boxes." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding."
 - 1. Install grounding electrode for each pole, unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - 1. Verify operation of photoelectric controls.

END OF SECTION 265619

SECTION 28 13 00 ACCESS CONTROL SYSTEM

PART 1 GENERAL

1.1 RELATED WORK

- A. Division 08 - Door Hardware
- B. Division 14 - General Elevator Requirements

1.2 DEFINITIONS

- A. ACS – Access Control System
- B. CSA – Client Software Application
- C. DGM – Dynamic Graphical Maps
- D. ALPR – Automatic License Plate Recognition
- E. SDK – Software Development Kit
- F. GLM – Genetec Lifecycle Management
- G. SSM – Server Software Module
- H. UI – User Interface
- I. USP – Unified Security Platform
- J. UWI – Unified Web Interface
- K. VMS – Video Management System

1.3 QUALIFICATIONS

- A. The system programmer shall have attended manufacturer training and obtained certification in Genetec™ Security Center - Synergis™ Technical Certification.
- B. Optionally, the system programmer shall have attended manufacturer training and obtained certification in Genetec Security Center - Enterprise Technical Certification.
- C. The system programmer shall be a Genetec certified partner with the following level of qualification: Certified Reseller or up
- D. The system programmer shall submit proof of certifications.

PART 2 PRODUCTS

2.1 ELECTRONIC ACCESS CONTROL SYSTEM GENERAL REQUIREMENTS

- A. The ACS shall be an enterprise class IP access control software solution. It shall be fully embedded within a Unified Security Platform (USP). The USP shall allow the seamless unification of the ACS with an IP video management system (VMS).
- B. The ACS shall be highly scalable to support configurations consisting of thousands of doors with facilities spanning multiple geographic areas.
- C. The ACS shall support an unrestricted number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.

- D. The ACS shall support a variety of access control functionalities, including but not limited to:
1. Controller (Unit) management, door management, elevator management, and area management.
 2. Cardholder and cardholder group management, Credential management, schedule management, and access rule management.
 3. Badge printing and template creation.
 4. Visitor Management.
 5. People counting, Area presence tracking, and mustering.
Offering a framework for third-party hardware integration such as biometric, mobile credentials, or other devices over IP.
- E. Manufacturer:
Genetec Security Center: Synergis Standard
- F. Certification
1. The ACS shall be certified
 - a. UL-294
 - b. ULC-S319
 - c. EN-60839-11-1
 - d. CSPN
FIPS 201
- G. The ACS shall support changing passwords of controller units (for a list of supported units, see the Security Center Administrator Guide):
1. The ACS shall show the strength of the current unit password.
 2. The ACS shall have the ability to change the password manually or using a string password generator for single or multiple units.
 3. The ACS shall have the ability to automatically update passwords on schedule.
 4. The ACS shall keep the history for passwords and the ability to retrieve them.
The ACS shall have the ability to export passwords of units for safekeeping.
- H. The ACS shall support managing certificates of controller units used for secure command and control (HTTPS and RTSPS) (for a list of supported units, see the Security Center Administrator Guide):
1. Push Initial Certificate
 2. Automatically switch from HTTP and RTSP to HTTPS and RTSPS
 3. Allow certificate renewal
 4. Manage certificates manually for a single device or a batch of devices
Automatically update upon configured schedule for single device or batch of devices
- I. The ACS shall be based on an open architecture able to support multiple access control hardware manufacturers. The ACS shall be able to integrate with multiple non-proprietary interface modules and controllers, access readers, and other third-party applications.

- J. The ACS shall support global Cardholder management and synchronization between a central independent site and remote independent sites, all of which can have their own Directory and databases.
- K. The ACS shall have an open architecture that supports the integration of third-party IP-based door controllers and I/O modules. The ACS shall simultaneously support mixed configurations of access control hardware from multiple vendors.
- L. Through the USP, the ACS shall support integration with an IPVideo Surveillance System or MVS. Integration with an IP video management system shall permit the user to view live and recorded video.
- M. The ACS shall support the discovery, configuration, and management of IP enabled controllers and I/O panels (hardware units). A user shall be permitted to add, delete, or modify a controller if they have the appropriate privileges.
- N. The ACS shall support the configuration and management of cardholders and cardholder groups. A user shall be able to add, delete, or modify a cardholder or cardholder group if they have the appropriate privileges.
- O. The ACS shall support the configuration and management of credentials, for example access cards and keypad PIN numbers. A user shall be able to add, delete, or modify a credential if the user has the appropriate privileges.
- P. A custom card format feature shall allow the administrator to add additional custom card formats using an intuitive tool within the Configuration UI.
- Q. The Badge designer shall allow the creation of badge templates that define the content and presentation format of a cardholder badge to be printed.
- R. The ACS shall support the configuration and management of doors. A user shall be able to add, delete, or modify a door if they have the appropriate privileges.
- S. The ACS shall support the configuration and management of elevators. A user shall be able to add, delete, or modify an elevator and elevator landings if they have the appropriate privileges.
- T. The ACS shall support the configuration and management of visitors. A user shall be able to enroll or remove a visitor if they have the appropriate privileges. The ACS shall support the check-in and check-out of visitors from the Monitoring UI.
- U. The ACS shall support people counting (or Area presence tracking). The ACS shall be able to monitor and report the number of cardholders in an area in real-time and for all areas. Monitoring shall be based on the entire access control infrastructure, for both local areas and those in remote geographic locations. People counting can also be used to perform mustering.
- V. The ACS shall permit the creation of custom fields. Up to 1,000 custom fields shall be supported.
- W. The ACS shall support an integrated Import tool to facilitate the import of existing cardholder, credential data, and cardholder group membership. The import of data shall be through the use of the CSV file format. The tool shall be available from the Configuration UI.

2.2 FAILOVER AND STANDBY REQUIREMENTS

- A. The USP shall support native and off-the-shelf failover options.

2.3 PHYSICAL ACCESS MANAGEMENT SYSTEM (PAMS)

- A. The system shall be an enterprise class physical access management system. It shall fully integrate within a Unified Security Platform (USP). The USP shall allow the seamless integration of the PAMS with Synergis Access Control System (ACS). It is the access provisioning solution for Synergis Access Control System (ACS) to allow efficient access management through a data-driven automation engine and the self-serve management portal.
- B. The PAMS shall be highly scalable for global deployments.
 - 1. The PAMS to support configurations with Synergis Access Control System.
 - 2. The PAMS system shall support licensing up to:
 - a. 1,000,000 unique identities
 - b. 500 sites
 - c. 1,000 visitor kiosks
 - d. 1,000,000 visits yearly
 - 3. Additionally, each account shall support up to:
 - a. 10,000 roles, with up to 100,000 identities in one role
 - b. 200,000 areas
- C. The PAMS shall support a variety of identity management functionalities, including but not limited to:
 - 1. Programmable management of cardholders for automatic access assignment
 - 2. Manual management of cardholders via workflows
- D. Manufacturer:
 - 1. Genetec ClearID
- E. Certification:
 - 1. The PAMS shall be an ISO/IEC 27001:2013 certified Information Security Management System.

2.4 PAMS ARCHITECTURE

- A. Globally distributed cloud architecture:
 - 1. Microsoft Azure
 - a. Distributed global services
 - 1) Policies and rules
 - 2) User authentication
 - 3) Area management
 - 4) API
 - 5) Self-service portal
 - 6) Workflows engine
 - 7) Email notification
 - 8) Automatic provisioning

- b. Regional Services
 - 1) The identities will be stored in the regional data center selected at account creation.
 - 2) Data is distributed across siloed, independent repositories.
- c. Local sites
 - 1) Security Center Synergis
 - 2) Local custom fields
 - 3) Plugins
- 2. High availability
 - a. 99.9 % SLA
 - b. Geo-redundant data storage
- 3. Security Controls
 - a. Data encryption
 - 1) AES 256
 - 2) RSA 2048
 - 3) Symmetric keys and asymmetric keys
 - a) Keys are managed using Azure Key Vault
 - (1) FIPS 140-2 Level 2 validated HSMs
 - b. Data integrity
 - 1) Digital signatures based on SHA 512 with RSA 2048 are used to validate data.
 - c. Communication encryption
 - 1) Hypertext Transfer Protocol Secure (HTTPS) protocol TLS 1.2
 - 2) Transport Layer Security (TLS) certificates
 - d. Zero-trust architecture
 - 1) Customer data is segmented into microservices, which only have the minimum data access requires to perform that task.
 - 2) All communication between microservices is encrypted and digitally signed.
 - e. Service monitoring
 - 1) Controls are updated based on various security threat feeds and services.
 - 2) System is running constant metrics analysis, including synthetic transactions to emulate user activity.
 - 3) Systems are monitored by and notify development and operations teams of any issues.
 - f. User authentications
 - 1) Azure Active Directory (AD) B2B by default
 - 2) Option for federation of existing AD user identities through Azure AD B2B or OpenID Connect to provide single sign-on (SSO).

- a) Also support:
 - (1) OneLogin
 - (2) Okta
 - (3) Auth0
 - (4) Ping
 - (5) MyID

B. Genetec ClearID™ Plugin

1. Installed on a Security Center server to integrate Genetec ClearID and Security Center, providing communications between Synergis and Genetec ClearID cloud Services.
2. Plugin is also installed on a Config Tool workstation, which allows that administrator to create and configure the plugin role and configure database settings and connection settings for ClearID.
3. Plugin will update automatically if an internet connection is available when a new release is published by Genetec.

2.5 PAMS MANAGEMENT

A. Identity management

1. Identity Information:
 - a. General personal information.
 - b. Company information.
 - c. Supervisors for this identity.
 - d. System shall synchronize identity information with the following sources:
 - 1) CSV file exported from and HR database.
 - 2) SQL Server or Oracle database.
 - 3) Microsoft Active Directory via LDAP.
 - 4) Azure Active Directory.
 - e. System shall have an externally available Identity REST API for synchronization of identity information from external sources.
 - f. Direct report management.
 - g. Supervisor can view a report of their direct report.
 - h. Supervisor can manage access and role membership of their direct report.
 - i. Supervisor can set up the delegation on behalf of their direct report. This action will delegate their direct report's tasks to someone else in the organization while their direct report is away on leave. The delegates will have the same set of permissions as the delegator and can manage the tasks on their behalf.
 - j. Identity request workflow.
 - k. Single request workflow or CSV import workflow to request identities that would add to the system using the web portal.
 - l. Identity template can be customized with pre-defined fields.

- m. Identity template is selected during identity request.
- n. Identity request approval workflow can be customized.
- o. Identity approvers can be assigned to approve an identity request.
- p. Supervisors and identity approvers can be required to approve, edit, and deny identity requests.
- q. Approvers can process identity requests using the ClearID web portal.
- r. Possibility of automatic role membership for newly created identity with the required areas automatically assigned based on the template used.
- s. Identity request approvers can delegate their tasks to someone else in the organization while they are away on leave. The delegate will have the same set of permissions as the delegator and can manage the tasks on their behalf.
- t. Email notifications when identity is requested.
- u. Email notifications when identity is approved or denied.
- 2. Access Control
 - a. Access period
 - 1) Date of activation
 - 2) Date of expiration
 - b. Provisioning attributes
 - c. Associated cardholders
- 3. User Permissions
 - a. Administrator can enable or disable user access to the web portal.
 - b. Administrator can assign user types:
 - 1) Administrator
 - 2) User
- 4. Visitor Management
 - a. Administrator can grant user permissions to invite visitors to specific sites.
- B. Area Management
 - 1. Area Management
 - a. Area's owners and approvers can view, add, and remove roles from areas.
 - b. Site owners can assign management to one of more area owners.
 - c. Area owners and approvers can delegate their tasks to someone else in the organization while they are away on leave (Example: vacation leave, sick leave, etc.). The delegate will have the same set of permissions as the delegator and can manage the tasks on their behalf.
 - d. Area approvers can perform access reviews for their area to confirm that the area access provisioned is required and valid.
 - 2. Access Control
 - a. Area owners and approvers can view, add, and remove people from areas.
 - b. Area owners and approvers can grant temporary access to roles.
 - c. Employee supervisor can be required to approve employee access request.

- d. Approvers can process access requests using the ClearID web portal.
 - e. Employee supervisors can delegate their tasks to someone else in the organization while they are away on leave. The delegate will have the same set of permissions as the delegator and can manage the tasks on their behalf.
 - 3. User Permissions
 - a. Approvers and supervisors can approve or deny access requests.
 - b. Permanent cardholders can request temporary access to areas.
 - c. Permanent cardholders can invite visitors.
- C. Role management
 - 1. Role Management
 - a. Assign the management roles or cardholder group to one or more role owners.
 - b. Role managers can add or remove people from their groups.
 - c. Role owners can assign access to an area for their entire group.
 - d. Automatic provisioning and synchronization of cardholder groups for multiple sites.
 - e. Role managers and owners can manage roles using the ClearID web portal.
 - f. Role managers and owner can delegate their tasks to someone else in the organization while they are away on leave. The delegate will have the same set of permissions as the delegator and can manage the tasks on their behalf.
 - g. Role managers can perform access reviews for their role to confirm that the access, provisioning policy, and role membership are valid.
 - h. Administrator can view access review role reports for the details of the role access reviews.
 - 2. Attribute and role-based provisioning.
 - a. Access can be granted or revoked based on employees' locations.
 - b. Access can be granted or revoked based on specific roles or job titles in the organization, or who they report to.
 - c. Access can be granted or revoked based on completion of specific training or possession of required certificates.
 - d. Access can be granted or revoked based on a list of custom provisioning attributes synchronized from an external source.
 - e. A grace period can be configured to delay the revocation of access by a configurable time period following a change in attributes.
- D. Site Management
 - 1. Site Management
 - a. Global management of cardholders for multiple Synergis systems.
 - b. Time zone support (built-in).
 - c. Site owners can delegate their tasks to someone else in the organization while they are away on leave. The delegate will have the same set of permissions as the delegator and can manage the tasks on their behalf.
 - d. Site owners can schedule access reviews.

- e. Email notifications will be sent to access review approvers that an access review is pending.
 - f. Site owners can view area access review reports for the details of the area access reviews.
 - 2. Access Control
 - a. Automatic synchronization of permanent credentials when someone travels between sites.
 - b. Synchronization of cardholders only happens when cardholders are changed, if the cardholder has access on that Synergis system.
 - c. Synchronization of cardholder groups only happens when cardholder groups are changed, if the cardholder group has access on that Synergis system.
- E. Visitor Management
 - 1. Visitor Management
 - a. Manual entry or CSV import pre-registration of visitors using the web portal.
 - b. Visitor approval workflow can be customized based on the area selected.
 - c. Visit event approval workflow options can be customized at the site level.
 - d. Visit event approvers can be assigned to approve a visit event.
 - e. Visit event approvers can delegate their tasks to someone else in the organization while they are away on leave. The delegate will have the same set of permissions as the delegator and can manage the tasks on their behalf.
 - f. Visitor watchlists can be used to screen visitors at an individual or company level.
 - g. Visitor watchlist behavior can block the visit confirmation from being sent to the visitor or can notify a watchlist manager that the visitor of interest is invited.
 - h. Automatic provisioning of visitors with the required areas automatically assigned.
 - i. Visitor check-in using Security Desk.
 - j. System shall support the configuration of self-service kiosks for visitor check-in.
 - 1) Kiosk shall be based on iPad hardware.
 - 2) Tabletop and floor stand kiosk options can be available.
 - 3) Kiosk supports visitor pre-registration and on-the-spot registration.
 - 4) Kiosk supports English, French, Spanish, Dutch, German, Italian, and Portuguese languages.
 - 5) Visitors shall be able to check in with a government ID (over 200 supported IDs) or with an email address.
 - 6) Refer to ClearID documentation for supported country IDs.
 - 7) QR code data can be sent to visitors in a Visitor Confirmation email prior to the visit. Kiosk shall have the ability to process the QR code data for the purpose of visitor check-in.

- 8) Kiosk shall have the ability to print temporary visitor badge with QR code credentials.
- 9) An SMS alert can be sent to the host when a visitor completes their check-in.
- 10) Kiosk supports Brother QL-820NWB thermal printer.
- 11) Kiosk themes options can be configured per site.
- 12) Kiosk check-in and check-out options can be configured.
- 13) Visit events can be updated prior to the start of a visit.
- k. Email notifications when a visit request is created.
- l. Email notifications when a visit request is approved or denied.
- m. Capture and report the visit reason.
- n. Email invitation sent to visitor with a meeting invite (iCalendar format – RFC 2445), site details, and optional QR code for file attachments.
- o. SMS notifications and email sent to the visitor host when the visitor checks in.
 - 1) Refer to ClearID documentation for supported country codes.
2. Access Control
 - a. Paper badges and temporary credentials for visitor management.
 - b. 40-bit QR code sent to visitors can be utilized as a credential in Security Center.
 - c. Access to specific areas can be restricted on a per-credential basis.
 - d. Visitor escort can be required, with up to 10 unique visitor hosts.
 - e. Approvers can process visitor access requests using the ClearID web portal.
- F. Platform Management
 1. Corporate logo for portal and email notifications.
 2. Cloud platform.
 3. HTML5 web interface with mobile support.
 4. REST API available to automate any functions available in the web portal.
- G. Security/Authentication Management
 1. Support multi-factor authentications for users using OpenID to connect.
 2. Single sign-on using Microsoft Office 365.
 3. Single sign-on using Microsoft Azure Active Directory (AD).
 4. ISO 27001:2013 certification.
 5. AES-256 encryption with RSA 2048 bits.
 6. System undergoes annual penetration testing by an external accredited security firm.

PART 3 EXECUTION

3.1 WARRANTY

- A. The product shall perform in all material respects in accordance with the accompanying user manual, and the media on which the Software Product resides will be free from defects in

materials and workmanship under normal use. Software defects are covered through Service Releases and Cumulative Updates which are available for a period of 1 year from the date of the software purchase.

- B. Extended warranty, up to 5 years, shall be available through the purchase of the Genetec Advantage support service which includes the following additional services over the standard warranty:
 - 1. Access to phone support and online chat for technical assistance
 - 2. Online case management
 - 3. Online System Availability Monitor
 - 4. Access to Major and Minor Release Upgrades

3.2 DEPLOYMENT SERVICES AND SYSTEM COMMISSIONING

A. General Requirements:

- 1. The contractor shall engage the services of the USP vendor to assist in the management of the deployment of the USP at the end user site on projects that involve:
 - a. Multiple contractors or subcontractors that will be responsible for deploying the USP at multiple client sites in different geographical regions.
 - b. Complex enterprise installations involving advanced functionality (for example The Federation™ feature, failover, plugins) and/or multiple systems (for example access control, video, ALPR) and/or third-party integrations.
 - c. Extensive use of customized solutions/plugins developed by the vendor that will be integrated into the USP.
- 2. The USP vendor services shall include Deployment Management and System Configuration and Commissioning.

B. Deployment Management Service:

- 1. The Deployment Management service from the vendor shall include a Project Manager acting as the single point of contact for all communications between the contractor and the vendor organization and who will be responsible for:
 - a. Conducting a Risk Assessment of the impact of potential risk factors on the operation of the vendor's USP.
 - b. Providing a project plan for the deployment of the vendor's USP.
 - c. Managing the development and deployment of the custom solution components that will be integrated into the vendor's USP (if applicable).
 - d. Providing a scope of work detailing the services to be provided by the vendor to assist in the deployment of the vendor's USP.
 - e. Coordinating and scheduling the vendor field services with the contractor to assist with the deployment of the vendor's USP.
 - f. Providing regular project status updates to the contractor regarding the development of Custom Solutions (if applicable) and the deployment of the vendor's USP.

C. Solution Architect Service:

1. The Solution Architect service from the vendor shall include a Solutions Architect Engineer acting as a single technical point of contact throughout the deployment of the USP, and who will be responsible for:
 - a. Assisting the contractor/subcontractor with the design and architecture of the vendor's USP.
 - b. Conducting technical consultation activities that may include fit/gap analysis, system design reviews, device compatibility assessments, functional and technical design reviews, as well as performance reviews of the vendor's USP.
 - c. Conducting a system assessment and ensuring best practices of the vendor's USP are followed.
 - d. Providing an upgrade and migration strategy for the vendor's USP where applicable.
 - e. Providing documentation of the system architecture, system design, hardware specifications and compatibility requirements, camera bandwidth calculations, and best practices as they relate to the vendor's USP.
 - D. System Configuration and Commissioning Service:
 1. The System Configuration and Commissioning service from the vendor shall include a Field Engineer who will be responsible for:
 - a. Assisting the contractor's or subcontractor's onsite/remote technicians with the configuration and commissioning of the vendor's USP at the client site.
 - b. Conducting a test of the USP following the deployment of the system using real-world operator scenarios to ensure optimal system performance.
 - c. Providing the contractor with a Service Report detailing the tasks completed during the deployment of the USP at the client site, as well as any recommendations for improving the performance of the USP that must be implemented by the contractor.
 - d. Providing a knowledge transfer of the vendor's USP to the contractor following the deployment of the USP at the client site.
- 3.3 MANUFACTURER END USER OPERATOR TRAINING
- A. The contractor shall engage the services of the USP vendor to assist in the end user training of the USP at the end user site.

END OF SECTION 281300

SECTION 283111 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. Work of this section includes specifications for the Fire Alarm System.

1.2 SUBMITTALS

- A. Product data and specification sheets for all equipment.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
 - 1. Wiring Diagrams/Drawings: Detail wiring for fire alarm control panel, remote annunciator panel. Cabling requirements for each fire alarm device. Single line riser diagram showing all equipment and type, number and size of all conductors.
 - 2. Product Certificates: Signed by manufacturers of equipment certifying that products furnished comply with specified requirements.
 - 3. Field Test Reports: Indicate and interpret test results for compliance with performance requirements, NFPA 72.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: The contractor for work under this section shall be licensed by the state of the project for the installation and maintenance of fire alarm systems. The contractor shall be an experienced installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section. All equipment supplied and installed under this Section shall be by the same installer.
- B. Provide electrical components, devices, and accessories which are UL listed and labeled as defined in NFPA 70, Article 100.
- C. The materials and methods used shall comply with the requirements of both NFPA 70 and 72.
- D. Each individual system operation on a circuit by circuit basis shall be tested for its complete operation. The procedure for testing the entire alarm system shall be as set forth by the code enforcement official, the Engineer, and the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Fire-lite
- 2.2 FIRE ALARM SYSTEM - GENERAL
- A. Coordinate features to form an integrated system. Match components and interconnections for optimum performance of specified functions.
 - B. Each addressable loop shall be circuited such that device loading does not exceed 80% of loop capacity. The loop shall have Class B operation.
 - C. Provide shutdown control relay(s), as required, for each HVAC fan system.
 - D. The system shall identify any abnormal condition and log each into the system database as an event.
 1. The system shall automatically display the first event of the highest priority on the control panel display. The priorities and types shall be alarm, supervisory, trouble, and monitor.
 2. The system shall have a Aqueue@ operation, and shall not require event acknowledgment by the system operator. The system shall have a labeled color coded indicator for each type of event. When an unseen event exists for a given type, the indicator shall flash. When all events for a given type have been displayed, the indicator shall change from flashing to steady.
 3. For each event, the display shall include the current time, the total number of events, the type of event, the time event occurred and a custom description of the event.
 4. The user shall be able to review each event by the use of scrolling keys.
 5. New alarm, supervisory, or trouble events shall sound a silenceable audible signal at the control panel.
 - E. Operation of any alarm initiating device shall automatically cause the following actions:
 1. Update the control/display as described above.
 2. Sound all alarm signals throughout the building at the evacuation rate.
 3. Turn on an alarm zone LED at the fire alarm control panel.
 4. Operate control relay contacts to return the elevator to the level directed by the local fire department.
 5. Operate control relay contacts to release all magnetic door locks throughout the building via the access control system.
 6. As required, operate control relay contacts to shutdown HVAC system fans.

7. Visually annunciate the location of the alarm on the remote annunciator panel. The visual indication shall remain on until the alarm condition is reset to normal.
- F. The entire fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the fire alarm control panel. Any opens, grounds, or disarrangement of system wiring and shorts across alarm horn/strobe wiring shall automatically cause the following actions:
1. Update the control panel display as described above.
 2. Visually and audibly annunciate a general trouble condition, on the remote annunciator panel. The visual indication shall remain on until the trouble condition is repaired.

2.3 FIRE ALARM CONTROL PANEL

- A. The existing fire alarm control panel is a Fire-Lite MS-5UD system.

2.4 ADDRESSABLE ANALOG DEVICES

A. General requirements --

1. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, number of alarms and troubles, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.
2. Each device shall be capable of electronic addressing, either automatically or application program assigned, to support physical/electrical mapping and supervision by location. Setting a device's address by physical means shall not be necessary.

B. Intelligent Modules - General

1. Intelligent modules shall be addressable without the use of DIP or rotary switches. The personality of multifunction modules shall be programmable at the site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes are not acceptable. Each module shall have a minimum of two diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to indicate communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing diagnostic codes for use in troubleshooting.
 - a. Input and output circuit wiring shall be supervised for open and ground faults.
 - b. The module shall be suitable for operating in 32 to 120 deg F, and 0-93% RH, non-condensing environments.
 - c. Single input modules shall provide one supervised Class B input circuit supporting at least the following circuit types:
 - 1) Normally-Open Alarm Latching (manual stations, heat detectors, etc.)

- 2) Normally-Open Alarm Delayed Latching (waterflow switches)
 - 3) Normally-Open Active Non-Latching (monitor, fans, dampers, etc)
 - 4) Normally-Open Active Latching (supervisory, tamper switches)
- d. Dual input modules shall provide two supervised Class B input circuits supporting the same circuit types described for the single input module.
 - e. Monitor modules shall support one supervised Class B, Normally-Open Active Non-Latching Monitor circuit.
 - f. Waterflow/Tamper modules shall support two supervised Class B input circuits. One circuit shall support a Normally-Open Alarm Delayed Latching Waterflow Switch circuit. The other circuit shall support a Normally-Open Active Latching Tamper Switch.
 - g. Control relay modules shall provide at least one form AC@ dry relay contact rated 2 amps at 24 Vdc for interlocking with external equipment. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.
 - h. Manual Pull Stations
 - 1) Manual pull stations shall be addressable without the use of DIP or rotary switches. Manual stations shall have a minimum of two diagnostic LEDs mounted on their input module. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The station shall be capable of storing diagnostic codes for use in troubleshooting the system.
 - 2) Input circuit wiring shall be supervised for open and ground faults.
 - 3) The pull station shall be suitable for operation in 32-120 deg F., 0-93% RH, non-condensing, environmental conditions.
 - 4) The pull station shall be double action single stage devices of lexan construction with an internal toggle switch. Provide a key locked test feature.
 - 5) The pull station shall be red with white APULL IN CASE OF FIRE@ lettering.
 - 6) The pull stations shall be of the same manufacturer as the fire alarm panel "Fire-Lite"

C. Notification Appliances

1. All notification appliances shall be UL listed for Fire Protective Service.
 - a. All strobe or combination appliances with strobes shall be capable of providing the AEquivalent Facilitation@ allowed under the Americans with Disabilities Act Accessabilities Guidelines and shall be UL 1971 and ULC S526 Listed.
 - b. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure compatibility between the appliances and the control panels.
 - c. Self-synchronized strobes of the candela output shown shall be provided as indicated on the plans. Each strobe shall have in-out screw terminals for wiring. Each strobe shall have a red plastic housing. Strobes shall have synchronized flash outputs to meet ADA requirements. The strobe shall have lens markings oriented for wall mounting.
 - d. Temporal horns of the output shown shall be provided as indicated on the plans. Each horn shall have in-out screw terminals for wiring. Each horn shall have a red plastic housing. Horns shall be selectable for high or low dBA output. Selection of low or

- high output shall be reversible. Horns shall be selectable for steady or temporal output. Selection of steady or temporal output shall be reversible.
- e. Combination strobe/horn devices shall be provided as indicated on the plans. Each combination device shall meet the same specs as the individual devices described above.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment to comply with manufacturer's written instructions.
- B. Install wiring in raceway. Conceal cable and raceway except in unfinished spaces. Electrical contractor to provide and install needed raceway with pullstring and backboxes. Coordinate requirements between Fire Alarm System installer and electrical contractor. Fire Alarm System installer to provide and install all cable and make all connections.
- C. Install any exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed to avoid damage to cables. Secure cable at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, or fittings.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use lacing bars in cabinets.
- E. End of line resistors shall be furnished and installed as required by the manufacturer.
- F. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables to identify media in coordination with system wiring diagrams.

3.2 TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment.
- B. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 283111

SECTION 310519.13 - GEOTEXTILES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Woven geotextile material
2. Nonwoven geotextile material.

1.2 SUBMITTALS

- A. Product Data: Manufacturer information including tensile strength, elongation, thickness, UV resistance, and other material specifications.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM D4873.
- B. Store materials according to manufacturer instructions.
- C. Protection:
 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 WOVEN GEOTEXTILE MATERIALS

A. Description:

1. Non-biodegradable, UV-resistant, woven geotextile fabric.
2. Material: Polypropylene.
3. Edges: Selvaged or finished to prevent separation of outer material.
4. Calendar such that yarns will retain relative positions.

B. Performance and Design Criteria:

1. Apparent opening size:

- a. 70 sieve.
 - b. Comply with ASTM D4751.
2. Minimum Permittivity:
 - a. .02 Sec⁻¹
 - b. Comply with ASTM D4491.
3. Puncture:
 - a. 120 lb.
 - b. Comply with ASTM D4833.
4. Tensile Strength (Grab):
 - a. 300 lb/ft..
 - b. Comply with ASTM D4632/D4632M.
5. Elongation at Break:
 - a. 15 percent.
 - b. Comply with ASTM D4632.
6. Mullen Burst:
 - a. 600 psi minimum.
 - b. Comply with ASTM D3786.
7. Trapezoidal Tear:
 - a. 120 lb.
 - b. Comply with ASTM D4533.
8. UV Resistance at 500 Hours:
 - a. Strength Retention: 70 percent.
 - b. Comply with ASTM D4355/D4355M.

2.2 NONWOVEN GEOTEXTILE MATERIALS

A. Description:

1. Non-biodegradable, UV-resistant, nonwoven geotextile fabric.
2. Material: Polypropylene.
3. Edges: Salvaged or finished to prevent separation of outer material.
4. Calendar such that yarns will retain relative positions.

B. Performance and Design Criteria:

1. Minimum Unseamed Sheet Width: 12.5 feet.
2. Apparent Opening Size:
 - a. No. 100 U.S. standard sieve size.
 - b. Comply with ASTM D4751.
3. Water Permittivity: 1.5 per second, minimum average roll value.
4. Vertical Water Flow Rate:
 - a. 105 gpm/sq. ft., minimum average roll value.
 - b. Comply with ASTM D4491/D4491M.
5. Tensile Strength (Grab Method):
 - a. 180 lbf, minimum average roll value.
 - b. Comply with ASTM D4632/D4632M.
6. Elongation at Break:
 - a. 50 percent, minimum average roll value.
 - b. Comply with ASTM D4632/D4632M.
7. Trapezoidal Tear Strength:
 - a. 75 lbf, minimum average roll value.
 - b. Comply with ASTM D4533/D4533M.
8. Puncture Strength:
 - a. 105 lbf, minimum average roll value.
 - b. Comply with ASTM D4833/D4833M.

9. UV Resistance at 500 Hours:
 - a. Strength Retention: 70 percent.
 - b. Comply with ASTM D4355/D4355M.
10. Mullen Burst:
 - a. 350 minimum.
 - b. Comply with ASTM D3786.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that underlying surface is smooth and free of ruts or protrusions that could damage geotextile material.

3.2 PREPARATION

- A. Subgrade Material and Compaction Requirements: As specified in Section 312323 - Fill.

3.3 INSTALLATION

A. Geotextile Material:

1. Lay and maintain smooth and free of tensile stresses, folds, wrinkles, or creases.
2. Ensure that material is in direct contact with subgrade.
3. Orientate with long dimension of each sheet parallel to direction of slope.
4. Minimum Unseamed Joints Overlap: 6 inches.

B. Securement Pins:

1. Insert through geotextile midway between edges of overlaps and minimum 3 inches from free edges.
2. Minimum Spacing:
 - a. Slopes Steeper than 3 Horizontal on 1 Vertical: 18 inches o.c.
 - b. Slopes 3 Horizontal on 1 Vertical to 4 Horizontal on 1 Vertical: 2 feet o.c.
 - c. Slopes Flatter than 4 Horizontal on 1 Vertical: 4 feet o.c.
3. Ensure that washer bears against geotextile.

C. Seams:

1. Minimum Seamed Joints Overlap: 6 inches at longitudinal and transverse joints.
2. Seams across Slope: Lap upper panel over lower panel.

D. Penetrations: As recommended by geotextile manufacturer.

E. Repairing Damaged Geotextiles:

1. Repair torn or damaged geotextile by placing patch of same type of geotextile over damaged area minimum of 18 inches beyond edge of damaged area, and fasten as recommended by geotextile manufacturer.
2. Remove and replace geotextile rolls which cannot be repaired.

F. Fill and Cover:

1. Place fill to prevent tensile stress or wrinkles in geotextile.
2. Place fill from bottom of side-slopes upward.
3. Do not drop fill from height greater than 2 feet.

3.4 PROTECTION

- A. Ballast: Adequate to prevent uplift of material by wind.
- B. UV Exposure: Do not leave material uncovered for more than 2days after installation.
- C. Do not use staples or pins to hold geotextiles in place where located adjacent to other geosynthetic layers that could be damaged.
- D. Do not operate equipment directly on top of geotextile.

END OF SECTION 310519.13

SECTION 316230 – AGGREGATE PIER SOIL IMPROVEMENT

PART 1 GENERAL

1.1 INTENT

This specification covers aggregate pier soil improvement methods by specialty subcontractors. The intent of the aggregate piers specified herein is to provide soil reinforcement within the limits indicated on the project drawings to achieve the degree of improvement required to meet the performance criteria in Section 3.3 of these specifications.

1.2 REFERENCE

S

A. Reference documents as provided to the aggregate pier contractor shall include:

1. This specification.
2. Project geotechnical report.
3. Contract documents.

1.3 DEFINITIONS

- A. Aggregate Piers are columns of compacted aggregate used to reinforce the ground to increase bearing capacity and reduce settlement of a structure. The piers can be constructed with a down-hole vibrator or down-hole tamper.
- B. Down-Hole Vibrators are specially-designed, high-energy depth vibrators. The horizontal vibrations are created by a motor and eccentric weight located near the tip of the vibrator. Extension tubes are bolted to the vibrator to allow it to be lowered to the necessary treatment depth.
- C. Bottom Feed Vibrators are down-hole vibrators which are equipped with a tremie pipe through which the aggregate is fed to the tip of the vibrator. This equipment is most often used in soil conditions which are too soft or cohesionless to remain open when pre-drilled.
- D. Down-Hole Tampers are proprietary high-energy impact apparatus. The vertical tamping energy is provided by a hammer which is connected to a round, beveled tamper. The apparatus is lowered into a pre-drilled hole to the required treatment depth.
- E. Field Quality Control Representative (FQCR): The Third-Party Individual or Entity given specific inspection tasks identified in this specification. The cost of services provided by the FQCR shall be included in the scope of the aggregate pier installer.

1.4 SCOPE OF WORK

- A. The work shall consist of installation, monitoring and testing of the aggregate piers within the limits indicated on the contract drawings to meet the performance criteria presented in Section 3.3 of these specifications.
- B. In connection with the aggregate pier program, the aggregate pier contractor shall provide all labor, materials, and equipment to accomplish the following items of work:
 - 1. Pre-drilling of holes as necessary and stockpiling of spoil within 100 feet of a completed pier.
 - 2. Construction of the aggregate piers to the lines and grades required.
- C. It shall be the aggregate pier contractor's responsibility to determine and implement the systems and criteria to ensure that the specified performance is achieved.

1.5 SUBMITTALS

- A. Aggregate pier soil improvement specialty contractors shall submit documentation for pre-approval to the Architect for review and approval a minimum of 7 working days prior to bid date. Documentation for pre-approval shall include at a minimum a list of at least five previously completed projects of similar scope and purpose (information shall include description of project, relative size, and contact person with phone number). In addition the following shall be included:
 - 1. Approximate depth and quantity of aggregate piers along with installation method.
 - 2. Modulus test detail and setup to be used to confirm the installation procedure produces the pier modulus to be used in the design.
 - 3. Resume and relevant experience for the professional engineer who will be taking responsibility for and sealing the aggregate pier soil improvement design and certifying its performance.
- B. The following shall be submitted to the Owner's representative by the aggregate pier contractor four (4) weeks prior to the start of the work:
 - 1. Resumes of the management, supervisory, key personnel, and FQCR.
 - 2. Description of proposed installation equipment.
 - 3. A ground improvement design based on information contained in the project geotechnical report, prepared by an engineer licensed in the state of the work to be performed that demonstrates that the program achieves the specified performances criteria as specified in Section 3.3 of these specifications.
 - 4. A shop drawing for review, indicating the spacing, location, and depth of the aggregate piers to achieve the criteria outlined in this specification.
 - 5. Modulus test detail and setup to confirm that the installation procedure produces the pier modulus used in the design.
 - 6. Proposed gradation and material characteristics of aggregate fill materials.

- C. The following shall be submitted to the Owner's representative by the aggregate pier contractor during the work:
1. Accurate daily records that include the type and size of compaction equipment and predrill auger diameter used, and, for each aggregate pier, the identification number and depth of the pier tip.
 2. Any change in the subsurface conditions observed during the work.
 3. The modulus test data, analysis of the data, and the concluding recommended design parameters, prepared by an engineer licensed in the state of the work.
- D. The FQCR shall perform and submit the following to the Owner's representative during the work:
1. Installation equipment
 2. Observe and record the drilled depth and geology of each aggregate pier element.
 3. Observe and record the number of lifts for each aggregate pier element.
 4. Record and perform bottom stabilization tests (BST) in at least 10% of the day's production aggregate pier elements.
 5. Record the relative density of the aggregate pier element utilizing a dynamic cone penetrometer (DCP) in accordance with ASTM STP-399.
 6. A daily installation report shall be developed to record the above items along with information on each geopier element such as column line, geopier number, type of element, geopier shaft length, and top of geopier elevation.
- E. The following shall be submitted to the Owner's representative by the aggregate pier contractor after the work is completed:
1. A report documenting the observations and results of the tests. This report will certify that the bearing pressure has been achieved within settlement tolerances.
 2. A warranty document good for one year.

1.6 QUALIFIED CONTRACTORS

The aggregate pier contractor shall meet the requirements stated in Section 1.5 of these specifications.

1.7 QUALITY ASSURANCE

- A. The aggregate pier program shall be performed by a specialist aggregate pier contractor with at least five continuous years of documented experience in aggregate piers.
- B. The aggregate pier contractor shall provide experienced management, supervisory and key personnel to implement the aggregate pier program.

- C. As detailed in Section 1.5, the aggregate pier contractor shall provide evidence of aggregate pier project experience.
- D. The Owner's representative (FQCR) will ensure that procedures and documentation conform to these specifications.

PART 2 EQUIPMENT AND MATERIALS

2.1 EQUIPMENT

A. Down-Hole Vibrator

- 1. Should the aggregate pier contractor use a down-hole vibrator, the vibrator shall be capable of providing at least 80 HP of rated energy and a centrifugal force of 15 tons. An appropriate metering device should be provided at such a location that inspection of amperage increase may be verified during the operation of the equipment. The metering device may be an ammeter directly indicating the performance of the vibrator tip. Complete equipment specifications should be submitted to the Engineer prior to commencement of the fieldwork.

B. Down-Hole Tamper

- 1. Should the aggregate pier contractor use a down-hole tamper, the tamper shall have a diameter that is at least 90% of the pre-drilled hole diameter, have beveled sides, and be long enough to reach the full depth of the pre-drilled hole. The tamper shall have a minimum Construction Industry Manufacturer's Association (CIMA) rating of 1,225 ft-lb and shall apply direct downward impact energy to each lift of aggregate. A minimum tamper energy level of 490,000 ft-lbs of force per minute shall be applied by the energy source.

2.2 BACKFILL MATERIALS

- A. Down-Hole Vibrator Method: The backfill aggregate should consist of hard, angular to sub-angular durable rock fragments, with the majority of particles in the range of 1/8th inch to 1-1/2 inches such as ASTM C33 size No. 57, or shall be other graded aggregate selected by the installer and successfully used in the modulus test.
- B. Down-Hole Tamper Method:
 - 1. Aggregate used for piers constructed above the water table shall be Type I, Grade B in accordance with ASTM D1241, or shall be other graded aggregate selected by the installer and successfully used in the modulus test.

2. For aggregate used for piers constructed below the water table, the gradation shall be the same as Type I Grade B, except that particles passing the number 40 sieve shall be eliminated. Alternately, No. 57 stone or other stone selected by the installer may be used.
3. When type I Grade B material is used, potable water or other suitable source shall be used to increase the aggregate moisture content when required.

PART 3 EXECUTION

3.1 AGGREGATE PIER CONSTRUCTION

- A. Prior to the installation of production aggregate piers install one test pier at direction of pier designer. The purpose of this test pier is to establish site-specific installation and construction control procedures to be used in the production work at each site. Test pier shall be located within the area of the deepest aggregate piers at each site, as approved by the Engineer. Perform a modulus test to evaluate the stiffness and verify the design criteria requirements shown on the plans of the aggregate pier. Perform the modulus test in general accordance with ASTM D-1143 or other approved test procedure to verify design criteria requirements.
- B. In addition to installing one test aggregate pier and performing modulus testing perform BST in the presence of the FQCR. The Engineer shall approve the initial aggregate piers and results of the modulus testing and BST prior to proceeding with the installation of production aggregate piers.
- C. Perform BST testing on 10% of aggregate production piers.

The general procedures are as follows:

- D. Stable Ground Conditions: The following general procedures shall be followed when the pre-drilled hole remains open during construction.
 1. Pre-drilling to the design depth will be performed with an auger diameter equal to the finished column diameter.
 2. Down-Hole Vibrator Method: The quantity of aggregate initially added shall be such that the vibrator tip is able to penetrate to within 12 inches of the design depth. The vibrator will be raised and lowered repeatedly, such that on each re-penetration, the tip of the vibrator advances to within 12 inches of the previous penetration depth.
 3. Down-Hole Tamper Method: Following placement of the first 12-inch lift of aggregate, the tamper is to be lowered to the top of the aggregate and activated. The full energy of the impactor and weight of the excavator shall be used for at least 30 seconds per lift, and subsequent lifts shall not exceed 12 inches in thickness.
 4. The aggregate shall be removed and replaced with fresh aggregate if cave-ins occur during the aggregate placement such that the volume of caved-in soil is

greater than 10 percent of the aggregate being compacted.

- E. Unstable Ground Conditions: The following general procedures will be followed when a pre-drilled hole will not remain open before or during pier construction.
1. Down-Hole Vibrator Method: If the hole will remain temporarily stable, the hole may be filled with aggregate to a level above the instability as long as the vibrator is still able to penetrate to within 1 foot of the pre-drilled depth. If the hole will not remain temporarily stable, a Bottom Feed Down-Hole vibrator may be used.
 2. Down-Hole Tamper Method: A casing with a minimum outside diameter equal to 100% of the pier diameter is advanced to the full treatment depth. The first 12-inch lift of aggregate will be placed, and the tamper lowered to the top of the aggregate. The full energy of the impactor and weight of the excavator shall be used for at least 30 seconds per lift, and subsequent lifts shall not exceed 12 inches in thickness. The casing is extracted after each lift is compacted with the bottom of the casing always maintained below the top of the aggregate.
- F. Obstructions: Aggregate piers shall be constructed within 6 inches of the design location. Obstructions encountered during excavation or drilling that will prevent installation of the aggregate piers to design depth, or cause the aggregate pier to stray from its specified location during installation shall be removed. To the extent the obstructions are shown in the geotechnical report, removal of obstructions shall be performed at no additional cost to the owner.
1. Obstructions include, but are not limited to, boulders, timbers, concrete, bricks, utility lines, etc., that prevent installing the aggregate piers to the required depth, or cause the aggregate pier to drift from the required locations. Dense natural rock or weathered rock shall not be deemed obstructions, and piers may be terminated short of design lengths on such materials. The aggregate pier design engineer shall be notified within 24 hours to verify that the short piers are acceptable.

3.4 PERFORMANCE CRITERIA

1. Construct appropriate aggregate piers with granular backfill material beneath all column foundations and load-bearing wall foundations to provide the following criteria upon completion:
 - a. Achieve the allowable soil load bearing capacity listed on the design drawings in psf under Dead Load only or Dead + Live Load with a maximum total settlement of 1 inch and a maximum differential settlement of ½ inch.
2. Aggregate piers should be constructed to a depth sufficient to satisfy the bearing and settlement criteria above. A modulus test shall be performed to verify the parameter

values utilized in the design of aggregate piers.

3.5 FIELD QUALITY ASSURANCE

A. Inspections

1. All aggregate pier operations shall be performed under the observation and documentation of the FQCR.
2. Monitoring and logging of aggregate pier operations for both test and production work shall be done by the FQCR.
3. The FQCR will provide site observation and documentation to ensure performance of the aggregate pier work.
4. The foundation bearing surface shall be compacted and firm prior to the construction of the foundation.

B. Modulus Test

Testing to determine specification compliance will be provided by the aggregate pier contractor, and will consist of at least one modulus test of an aggregate pier.

The results of the Modulus Test shall meet the following criteria to pass:

1. The geotechnical engineer shall approve of the location of the Modulus Test.
2. Deflections of the top of the test pier shall be measured by a suitable method.
3. Deflections at the bottom of the test pier shall be measured by means of a telltale installed at the bottom of the test aggregate pier. Performance will be deemed acceptable when, at the specified design stress, deflection at the bottom of the pier does not exceed 20% of the deflection at the top of the pier.
4. Load increments, decrements, and duration, shall be determined using ASTM D1143 as general guidelines.
5. Surficial disturbance shall be compensated for by applying a seating load equal to 5% of the total load to the loaded steel plate before applying load increments.
6. The modulus testing shall be performed as described in the Design Submittal.

3.6 REJECTION OF AGGREGATE PIERS

- A. If an aggregate pier is installed in an incorrect location or exceeds the specified tolerances, the aggregate pier contractor shall replace the pier. Pier replacement may be avoided if alternate remedial procedures are approved by the Designer. Unless the rejection is caused by obstruction, refusal in rock or dense soil or errors in the project drawings, the cost of all labor and material required for the replacement shall not be the responsibility of the Owner.

3.7 EXCAVATION OF PIER TOPS, AND UTILITIES

- A. Excavations conducted after aggregate pier installation shall be performed such that the horizontal distance between the edge of any aggregate pier and the nearest edge of the excavation is such that the pier is not affected. If installed aggregate piers are located within the zone of influence of excavation, the General Contractor and Engineer shall collaborate to develop solutions to excavation or construction methods that will avoid detrimental impact to the installed aggregate piers. Zone of influence shall be defined as within 5-ft. of aggregate pier elements.

3.8 FOOTING EXCAVATIONS

- A. Prior to placement of structural concrete, aggregate pier tops shall be excavated in a manner that will prevent the soil matrix surrounding the aggregate piers from softening, and ensure that a direct connection between the aggregate pier and concrete footing will be achieved.
- B. The following excavation procedures shall be followed:
 - 1. Over-excavation below the bottom of the footing shall be backfilled with lean concrete.
 - 2. Water shall not be allowed to pool in the footing excavation at any time. The footing bearing surface shall be free of all water and compacted prior to placement of any reinforcement. Compaction can be by any heavy tamping type compaction equipment designed for compaction in small spaces. The entire surface area of the footing bottom shall be compacted to ensure that any loose surface soil and/or loose surface aggregate is densified.
 - 3. Footing concrete shall be placed immediately following approval of the completed footing excavation work. It is ideal that approval of the excavation work be stated on the same day that the excavation takes place. If the bearing soils are expansive or sensitive, it is imperative that the footing concrete be placed on the same day that the excavation takes place.
 - 4. If footing concrete cannot be placed on the same day that excavation takes place, a minimum 3-inch thick mud mat shall be placed immediately following approval of the footing excavation. Mud slab shall have a roughened surface.
 - 5.

END OF SECTION 316230

SECTION 321123 - AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregate base course.

B. Related Sections:

1. Section 312213 - Rough Grading: Preparation of site for base course.
2. Section 312316.13 - Trenching: Compacted fill under base course.
3. Section 321216 - Asphalt Paving: Binder and finish asphalt courses.
4. Section 321313 - Concrete Paving: Finish concrete surface course.
5. Section 321416 - Brick Unit Paving: Finish pavers.
6. Section 330513 - Manholes and Structures: Manholes and Drains including frames.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.

B. ASTM International:

1. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
4. ASTM D2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit data for geotextile fabric and herbicide.

C. Samples: Submit, in air-tight containers, 10 lb sample of each type of aggregate fill to testing laboratory.

D. Materials Source: Submit name of aggregate materials suppliers.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS

- A. Base Aggregate: ASTM D2940; graded type.

1. Percent Passing per Sieve Size:

- a. 2 Inches ((50 mm):)100.
- b. 1-1/2 Inches ((37.5 mm):)95 to 100.
- c. 3/4 Inch ((19 mm):)70 to 92.
- d. 3/8 Inch ((9.5 mm):)50 to 70.
- e. No. 4 ((4.75 mm):)35 to 55.
- f. No. 30 ((0.600 mm):)12 to 25.
- g. No. 200 ((0.075 mm):)Zero to 8.

2.2 ACCESSORIES

- A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

- B. Verify compacted substrate is dry and ready to support paving and imposed loads.

1. Proof roll substrate with 20 ton roller in minimum two perpendicular passes to identify soft spots.
2. Remove soft substrate and replace with compacted fill as specified in Section 312323.

C. Verify substrate has been inspected, gradients and elevations are correct.

3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

3.3 AGGREGATE PLACEMENT

- A. Install geotextile fabric over subgrade according to manufacturer's instructions.
 1. Lap ends and edges minimum 6 inches.
 2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.
- B. Spread aggregate over prepared substrate to total compacted thickness indicated on Drawings.
- C. Roller compact aggregate to 95 density indicated on Drawings.
- D. Level and contour surfaces to elevations, profiles, and gradients indicated.
- E. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.
- F. Maintain optimum moisture content of fill materials to attain specified compaction density.
- G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Tolerances.
- B. Maximum Variation From Flat Surface: 1/2 inch measured with 10 foot straight edge.
- C. Maximum Variation From Thickness: 1/4 inch.
- D. Maximum Variation From Elevation: 1/2 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements and 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Compaction testing will be performed according to ASTM D1557, ASTM D2922, and ASTM D3017.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Frequency of Tests: One test for every 1000 square yards of each layer compacted aggregate.

3.6 COMPACTION

- A. Compact materials to 98 percent of maximum density as determined from test strip, according to ASTM D2940.

END OF SECTION 321123

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.

B. Related Requirement:

1. Section 312213 - Rough Grading: Preparation of site for paving and base.
2. Section 321123 - Aggregate Base Courses: Compacted subbase for paving.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M208 - Standard Specification for Cationic Emulsified Asphalt.
5. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
6. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
7. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
8. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

B. Asphalt Institute:

1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.
3. AI SP-2 - Superpave Mix Design.

C. ASTM International:

1. ASTM C1371[-2004a] - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
2. ASTM C1549[-2004] - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
3. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.
4. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
5. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
6. ASTM D977 - Standard Specification for Emulsified Asphalt.
7. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
8. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
9. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
10. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
11. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
12. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
13. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
14. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
15. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
16. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
18. ASTM E408[-1971(1996)e1] - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
19. ASTM E903[-1996] - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
20. ASTM E1918[-1997] - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
21. ASTM E1980[-2001] - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 1. Submit product information for asphalt and aggregate materials.
 2. Submit mix design with laboratory test results supporting design.

1.4 QUALITY ASSURANCE

- A. Mixing Plant: Conform to State of Louisiana Department of Transportation (DOTD).
- B. Mixing Plant: Certified by State of Louisiana DOTD.
- C. Obtain materials from same source throughout.
- D. Perform Work in accordance with State of Louisiana DOTD standard.

1.5 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.
- B. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- C. Place asphalt mixture when temperature is not more than 15 degrees F less than initial mixing temperature.

PART 2 - PRODUCTS

2.1 ASPHALT PAVING

- A. Performance / Design Criteria:
 - 1. Paving: Design for parking.
- B. Asphalt Materials:
 - 1. Asphalt Binder: AASHTO M320; performance grade PG 64-22.
 - 2. Primer: ASTM D2027, MC-30, MC-70; medium curing, cutback asphalt. In accordance with State of Louisiana DOTD standards.
 - 3. Tack Coat: In accordance with State of Louisiana DOTD standards.
 - 4. Reclaimed Asphalt Pavement (RAP): Processed material obtained by milling or full depth removal of existing asphalt paving.
 - 5. Oil: In accordance with State of Louisiana DOTD standards.
- C. Aggregate Materials:
 - 1. Coarse Aggregate: ASTM D692; crushed stone, gravel, or blast furnace slag.
 - 2. Coarse Aggregate: In accordance with Section 320516 Type A1. In accordance with State of Louisiana DOTD current standards.
 - 3. Fine Aggregate: In accordance with Section 320516 Type A5. In accordance with State of Louisiana DOTD current standards.

4. Mineral Filler: ASTM D242 or AASHTO M17; finely ground mineral particles, free of foreign matter.

2.2 MIXES

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Asphalt Paving Mixtures: Superpave type; designed and tested in accordance with AI SP-2 with maximum 20 percent by weight reclaimed asphalt pavement.
 1. Wearing Course: Level A.
- C. Paving Surfaces: Minimum solar reflectance index (SRI) of 29, calculated in accordance with ASTM E1980.
 1. Reflectance: Measured in accordance with ASTM E903, ASTM E1918, or ASTM C1549.
 2. Emittance: Measured in accordance with ASTM E408 or ASTM C1371.

2.3 ACCESSORIES

- A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.
- C. Verify compacted subgrade subbase is dry and ready to support paving and imposed loads.
 1. Proof roll subbase with a 30 ton roller in minimum two perpendicular passes to identify soft spots.
 2. Remove soft subbase and replace with compacted fill as specified in Section 312323.
- D. Verify gradients and elevations of base are correct.
- E. Verify gutter drainage grilles and frames and manhole frames and are installed in correct position and elevation.

3.2 DEMOLITION

- A. Saw cut and notch existing paving as indicted on Drawings.
- B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.
- C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

3.3 INSTALLATION

A. Subbase:

- 1. Aggregate Subbase: Install as specified in Section 321123.

B. Primer:

- 1. Apply primer in accordance with AI MS-2. State of Louisiana DOTD standards.
- 2. Use clean sand to blot excess primer.

C. Tack Coat:

- 1. Apply tack coat in accordance with AI MS-19 State of Louisiana DOTD current standards.
- 2. Apply tack coat to contact surfaces of curbs, gutters and existing asphalt surfaces.
- 3. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.

D. Single Course Asphalt Paving:

- 1. Install Work in accordance with State of Louisiana DOTD standards.
- 2. Place asphalt within 24 hours of applying primer or tack coat.
- 3. Place asphalt wearing course to thickness indicated on Drawings.
- 4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
- 5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

E. Double Course Asphalt Paving:

- 1. Place asphalt binder course within 24 hours of applying primer or tack coat.
- 2. Place binder course to thickness identified in schedule at end of section] [thickness indicated on Drawings.
- 3. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
- 4. Place wearing course to thickness indicated on Drawings.

5. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
6. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Tolerances.
- B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- C. Scheduled Compacted Thickness: Within 1/4 inch.
- D. Variation from Indicated Elevation: Within 1/2 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting, testing.
- B. Take samples and perform tests including mat density tests in accordance with State of Louisiana DOTD current standards.
- C. Asphalt Paving Mix Temperature: Measure temperature at time of placement.
- D. Asphalt Paving Thickness: ASTM D3549; test one core sample from every 1000 square yards compacted paving.
- E. Asphalt Paving Density: ASTM D2950 nuclear method; test one location for every 1000 square yards compacted paving.

3.6 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Immediately after placement, protect paving from mechanical injury for 48 hours or until surface temperature is less than 140 degrees F.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregate base course.
2. Concrete paving for:
 - a. Concrete integral curbs and gutters.
 - b. Concrete parking areas and roads.

B. Related Requirements:

1. Section 312213 - Rough Grading: Preparation of site for paving and base.
2. Section 321123 - Aggregate Base Courses.
3. Section 321216 - Asphalt Paving: Asphalt wearing course.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

B. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:

1. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
3. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
5. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
6. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

7. ASTM A775/A775M - S Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
8. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
9. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
10. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
11. ASTM C33 - Standard Specification for Concrete Aggregates.
12. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
13. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
14. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
15. ASTM C150 - Standard Specification for Portland Cement.
16. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
17. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
18. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
19. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
20. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
21. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
22. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
23. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
24. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
25. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
26. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
27. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
28. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
29. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
30. ASTM C1371[-2004a] - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
31. ASTM C1549[-2004] - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
32. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
33. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
34. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
35. ASTM E408[-1971(1996)e1] - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

36. ASTM E903[-1996] - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
37. ASTM E1918[-1997] - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
38. ASTM E1980[-2001] - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 PRE-INSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 1. Submit data on concrete materials, joint filler, admixtures and curing compounds.
- C. Design Data:
 1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Hot and cold weather concrete work.
 2. Identify mix ingredients and proportions, including admixtures.
 3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

1.5 QUALITY ASSURANCE

- A. Perform Work according to ACI 301.
- B. Obtain cementitious materials from same source throughout.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 5 years' documented experience.

1.7 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.
- B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 AGGREGATE BASE COURSE

- A. Aggregate Base Course: As specified in Section 321123.

2.2 CONCRETE PAVING

- A. Performance / Design Criteria:
 - 1. Paving: Design for parking light duty commercial vehicles, movement of trucks up to 30,000 lbs, movement of trucks up to 60,000 lbs . _
- B. Form Materials:
 - 1. Form Materials: Conform to ACI 301.
 - 2. Wood or Steel form material, profiled to suit conditions.
 - 3. Joint Filler: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/4 inch thick.
- C. Reinforcement:
 - 1. Deformed Reinforcing: Steel: ASTM A615/A615M, 60 ksi yield grade, deformed billet bars, uncoated finish.
 - 2. Welded Plain Wire Fabric: ASTM A185/A185M; in coiled rolls; unfinished.
 - 3. Dowels: ASTM A615/A615M; 60 yield strength, plain steel bars; cut to length indicated on Drawings, square ends with burrs removed; unfinished.
 - 4. Tie Wire: Minimum 16ting Patching Material: Type as recommended by coating manufacturer.
- D. Concrete Materials:
 - 1. Concrete Materials: As specified in Section 033000.

2.3 FABRICATION

- A. Fabricate reinforcing according to CRSI Manual of Practice.

2.4 MIXES

A. Concrete Mix - By Performance Criteria:

1. Mix and deliver concrete according to ASTM C94/C94M, Option A.
2. Provide concrete to the following criteria:
 - a. Compressive Strength: 4000 psi at 28 days.
 - b. Slump: 3 to 5 inches.
 - c. Air Entrainment: 4 percent.

2.5 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 2, Class B.
- B. Joint Sealers: Specified in Section 079000.
- C. Joint Sealers: ASTM D6690, Type I; hot applied type.

2.6 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing and Inspection Services:.
- B. Submit proposed mix design of each class of concrete for review prior to commencement of Work.
- C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.
- D. Test samples according to ASTM C94/C94M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify compacted subgrade is dry and ready to support paving and imposed loads.
 1. Proof roll subbase with 30 ton roller in minimum two perpendicular passes to identify soft spots.
 2. Remove soft subbase and replace with compacted fill as specified in Section 312323.
- C. Verify gradients and elevations of base are correct.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Moisten substrate to minimize absorption of water from fresh concrete.
- C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete paving.
- D. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.3 INSTALLATION

- A. Forms:
 - 1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
 - 2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- B. Reinforcement:
 - 1. Place reinforcing as indicated on Drawings.
 - 2. Interrupt reinforcing at expansion joints.
 - 3. Place reinforcing to achieve paving and curb alignment as detailed.
 - 4. Provide doweled joints at spacing as detailed on drawings
- C. Placing Concrete:
 - 1. Coordinate installation of snow melting components.
 - 2. Place concrete as specified in Section 033000.
 - 3. Ensure reinforcing, inserts, embedded parts, formed joints and dowel baskets are not disturbed during concrete placement.
 - 4. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
 - 5. Place concrete to joint pattern indicated.
- D. Joints
 - 1. Place expansion and contraction joints as indicated on plans. Align curb, gutter, and sidewalk joints.
 - 2. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for sealant installation.
 - 3. Provide sawn joints as indicated on plan details.
 - 4. Provide keyed joints as indicated.
 - 5. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.
 - 6. Seal joints as indicated on Drawings according to Section 079000.
- E. Finishing:

1. Paving: Light broom.
2. Sidewalk Paving: Light broom, radius to 1/8 inch radius, and trowel joint edges.
3. Curbs and Gutters: Light broom.
4. Direction of Texturing: Transverse to paving direction.
5. Inclined Vehicular Ramps: Broomed perpendicular to slope.
6. Place curing compound on exposed concrete surfaces immediately after finishing.

F. Curing and Protection

1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Tolerances.
- B. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- C. Maximum Variation From True Position: 1/4 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting, testing.
- B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. Perform field inspection and testing according to ASTM C94/C94M.
- D. Inspect reinforcing placement for size, spacing, location, support.
- E. Testing firm will take cylinders and perform slump and air entrainment tests according to ACI 301.
- F. Strength Test Samples:
 1. Sampling Procedures: ASTM C172.
 2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
 3. Sample concrete and make one set of four cylinders for every 150 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area paving.
 4. Make one additional cylinder during cold weather concreting, and field cure.
- G. Field Testing:
 1. Slump Test Method: ASTM C143/C143M.

2. Air Content Test Method: ASTM C231.
3. Temperature Test Method: ASTM C1064/C1064M.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

H. Cylinder Compressive Strength Testing:

1. Test Method: ASTM C39/C39M.
 2. Test Acceptance: Average compressive strength of three consecutive test maximum 500 psi less than specified compressive strength.
 3. Test one cylinder at 7 days.
 4. Test two cylinders at 28 days.
 5. Retain one cylinder for 56 days for testing when requested by Architect/Engineer.
 6. Dispose remaining cylinders when testing is not required.
- I. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.6 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Do not permit vehicular] traffic over paving for 7 days minimum after finishing or until 75 percent design strength of concrete has been achieved.

3.7 ATTACHMENTS

- A. Concrete Sidewalks: 3,000 psi 28 day concrete.
- B. Parking Area Paving: 4,000 psi 28 day concrete, thick, light broom finish.

END OF SECTION 321313

SECTION 321623 - SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Concrete paving for sidewalks.
- B. Related Requirements:
 - 1. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components.
 - 2. Section 312213 - Rough Grading: Preparation of Site for paving.
 - 3. Section 312323 - Fill: Compacted subgrade for paving.
 - 4. Section 321123 - Aggregate Base Courses: base course.

1.2 REFERENCE STANDARDS

- A. American Concrete Institute:
 - 1. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- B. ASTM International:
 - 1. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 2. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - 3. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 4. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
 - 5. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 6. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 - 7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - 8. ASTM C150/C150M - Standard Specification for Portland Cement.
 - 9. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
 - 10. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete.
 - 11. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - 12. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 13. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.

14. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
15. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
16. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements.
17. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
18. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
19. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
20. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars.
21. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
22. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
23. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete.
24. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
25. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
26. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
27. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
28. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
29. ASTM D5893/D5893M - Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
30. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 1. Submit required information regarding concrete materials, joint filler, admixtures, and curing compounds.
 2. Mix Design:
 - a. Submit concrete mix design for each concrete strength prior to commencement of Work.
 - b. Submit separate mix designs if admixtures are required for hot- and cold-weather concrete Work.
 - c. Identify mix ingredients and proportions, including admixtures.

3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

1.4 QUALITY ASSURANCE

- A. Perform Work according to Sections 031000 - Concrete Forming and Accessories, 032000 - Concrete Reinforcing, and 033000 - Cast-in-Place Concrete.
- B. Obtain cementitious materials from same source throughout.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 2. Provide additional protection according to manufacturer instructions.

1.7 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Minimum Conditions: Do not place concrete if base surface temperature is less than 40 deg. F, or if surface is wet or frozen.
- C. Subsequent Conditions: Maintain minimum 50 deg. F, for not less than 72 hours after placing, and at a temperature above freezing for remainder of curing period.

1.8 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 AGGREGATE SUBGRADE

- A. As specified in Section 321123 - Aggregate Base Courses.

2.2 MATERIALS

A. Forms:

1. Description: As specified in Section 031000 - Concrete Forming and Accessories.
2. Height: Equal to full depth of finished sidewalk.

B. Forms:

1. Material:
 - a. Wood: Straight and free from warping, twisting, loose knots, splits, or other defects.
2. Profile: To suit conditions.
3. Joint Filler:
 - a. Material: Asphalt-impregnated fiberboard or felt.
 - b. Comply with ASTM D1751.
 - c. Thickness: 1/4 inch.

C. Concrete:

1. Concrete Materials:
 - a. As specified in Section 033000 - Cast-in-Place Concrete.

2.3 FABRICATION

A. Reinforcing:

1. Comply with CRSI Manual of Practice.

B. Hooks:

1. As indicated on Drawings.

2.4 MIXES

A. Concrete:

1. Comply with ASTM C94/C94M, Option A, C.

2.5 ACCESSORIES

A. Curing Compound:

1. Comply with ASTM C309.
2. Type: 2.
3. Class: B.

B. Joint Sealers: As specified in Section 079000 - Joint Protection.

C. Joint Sealers:

1. Hot Applied:
 - a. Comply with ASTM D6690.
 - b. Type: I.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- C. Verify that gradients and elevations of subgrade are as indicated on Drawings.
- D. Verify reinforcing placement for proper size, spacing, location, and support.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

- B. Moisten substrate to minimize absorption of water from fresh concrete.

3.3 INSTALLATION

- A. Subgrade:

- 1. As specified in Section 321123 - Aggregate Base Courses.

- B. Forms:

- 1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
 - 2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
 - 3. Clean forms and coat with form oil each time before concrete is placed.
 - 4. Wood Forms: Thoroughly wet with water before concrete is placed.

- C. Reinforcement:

- 1. Place reinforcing at mid-height of paving.
 - 2. Place reinforcing as indicated on Drawings.
 - 3. Interrupt reinforcing at expansion joints.
 - 4. Place reinforcing to achieve indicated paving alignment.
 - 5. Provide doweled joints at transverse joints, interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.

- D. Placing Concrete:

- 1. As specified in Section 033000 - Cast-in-Place Concrete.
 - 2. Ensure that reinforcing, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
 - 3. Place concrete continuously over full width of panel and between predetermined construction joints.
 - 4. Do not break or interrupt successive pours such that cold joints occur.
 - 5. Consolidate concrete by tamping and vibration.
 - 6. Place concrete to pattern as indicated.

- E. Joints:

- 1. Place continuous transverse expansion and contraction joints at 5 -foot intervals or width of sidewalk, whichever is less.
 - 2. Filler:
 - a. Place joint filler between paving components and building or other appurtenances.
 - b. Recess top of filler 1/4 inch for sealant installation.
 - 3. Provide scored joints at 3-foot intervals between sidewalks and curbs.
 - 4. Provide keyed joints as indicated on Drawings.

- F. Finishing:

1. Light broom and trowel edges of joints.
2. Texture Direction: Transverse to paving direction.
3. Ramps: V-joint perpendicular to slope.
4. Place curing compound on exposed concrete surfaces immediately after finishing.
5. Edges and Joints:
 - a. Edger Radius: 1/8 inch.
 - b. Spalled Corners and Edges: Clean and fill with mortar mixture and finish.

G. Curing:

1. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
2. Membrane Curing:
 - a. Apply membrane-curing compound uniformly to exposed surface after free water has disappeared from finished surface and before concrete has dried.
 - b. Apply compound in two coats, with second coat applied perpendicular to first coat.
 - c. If concrete has dried, moisten dried surface and apply curing compound as soon as free water disappears.

H. Backfilling: After curing, backfill, grade, and compact adjacent disturbed area as indicated.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.
- C. Maximum Variation from True Position: 1/4 inch.
- D. Line and Grade for Forms: 1/8 inch in any 10-foot- long section.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Inspection and Testing:
 1. Comply with ASTM C94/C94M.
 2. Samples:
 - a. Sampling Procedures: Comply with ASTM C172/C172M.
 - b. Cylinder Molding and Curing Procedures: Comply with ASTM C31/C31M, standard cured.

- c. Sample concrete and make one set of four cylinders for every 150 cu. yd. or less of each class of concrete placed each day, and for every 5,000 sq. ft. of surface area paving.
 - d. Make one additional cylinder during cold-weather concreting, and field cure.
- 3. Cylinder Compressive Strength:
 - a. Comply with ASTM C39/C39M.
 - b. Acceptance:
 - 1) Average Compressive Strength of Three Consecutive Tests: Maximum 500 psi less than specified compressive strength.
 - c. Test one cylinder at seven days, and two cylinders at 28 days.
 - d. Retain one cylinder for 56 days for testing when requested by Architect/Engineer.
 - e. Dispose of remaining cylinders if testing is not required.
- 4. Slump, Temperature, and Air Content:
 - a. Measure for each compressive-strength concrete sample.
 - b. Slump: Comply with ASTM C143/C143M.
 - c. Air Content: Comply with ASTM C173/C173M, C231/C231M.
 - d. Temperature: Comply with ASTM C1064/C1064M.
- 5. Records:
 - a. Maintain records of placed concrete items.
 - b. Record date, location of pour, quantity, air temperature and number of test samples taken.

3.6 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, rain and flowing water, and mechanical injury.
- C. Do not permit traffic over paving for minimum 7 days after finishing or until 70 percent design strength of concrete has been achieved.
- D. Damaged Concrete:
 - 1. Remove and reconstruct concrete that has been damaged for entire length between scheduled joints.
 - 2. Refinishing damaged portion is not acceptable.
 - 3. Dispose of damaged portions.

3.7 ATTACHMENTS

- A. Concrete Sidewalks: 3000-psi 28-day concrete, 4 inches thick.

END OF SECTION 321623

SECTION 329223 - SODDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of subsoil.
2. Placement of topsoil.
3. Fertilization.
4. Sod installation.
5. Maintenance.

B. Related Requirements:

1. Section 312316.13 - Trenching: Rough grading over cut.
2. Section 312323 - Fill: Rough grading of Site.
3. Section 329219 - Seeding: Seeding and soil supplements.

1.2 DEFINITIONS

- A. Weeds: Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.3 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. Turfgrass Producers International:

1. TPI - Guideline Specifications to Turfgrass Sodding.

1.4 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.

- B. Coordinate Work of this Section with installation of underground sprinkler system piping and watering heads.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 - 1. Submit sod producer's information for sod grass species.
 - 2. Submit manufacturer information for fertilizer, mulch, and other accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Sod Producer's Certificate: Certify that sod grass meets or exceeds specified requirements.
- E. Test and Evaluation Reports: Indicate topsoil nutrient and pH levels, with recommended soil supplements and application rates.

1.6 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Operation and Maintenance Data:
 - 1. Submit fertilizer types, application frequency, and recommended coverage.

1.7 QUALITY ASSURANCE

- A. Sod: Ensure root development capable of supporting its own weight without tearing when suspended vertically by holding upper two corners.

1.8 QUALIFICATIONS

- A. Sod Producer: Company specializing in products as specified in this Section with minimum three years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Delivery:
 - 1. Deliver sod on pallets.

2. Do not deliver more sod than can be laid within 24 hours.
- C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- D. Store materials according to manufacturer instructions.
- E. Protection:
 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 2. Protect exposed roots from dehydration.
 3. Provide additional protection according to manufacturer instructions.

1.10 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Minimum Conditions: Do not place sod when temperature is lower than 32 deg. F.

PART 2 - PRODUCTS

2.1 SOD

- A. Description:
 1. Cultivated grass sod with strong fibrous root system, free of stones and burned or bare spots.
 2. Grade: Nursery grown.
 3. Type: As indicated in plant schedule on Drawings.
 4. Weed Density: No more than five weeds per 1,000 sq. ft.
 5. Percentage Grass Type:
 - a. Bermuda: 100 percent.
- B. Harvesting of Sod:
 1. Machine-cut sod and load on pallets according to TPI.
 2. Cut sod in area not exceeding 1 sq. yd., with minimum 1/2-inch and maximum 1-inch topsoil base.

2.2 MATERIALS

- A. Topsoil:

1. Description: Fertile, agricultural soil typical for locality, capable of sustaining vigorous plant growth, and taken from drained Site.
2. Free of subsoil, clay, impurities, plants, weeds, and roots.
3. pH:
 - a. Minimum: 5.4.
 - b. Maximum: 7.0.

2.3 ACCESSORIES

A. Fertilizer:

1. Grade: Commercial.
2. Description: As recommended for grass, with 50 percent of elements derived from organic sources.
3. Proportions: As necessary to eliminate deficiencies of topsoil.

B. Lime:

1. Description: Agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent.
2. Comply with ASTM C602.
3. Class: T, O.

C. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of grass.

D. Wood Pegs: Softwood, sufficient size and length to anchor sod on slope.

E. Wire Mesh:

1. Description: Interwoven hexagonal plastic mesh.
2. Size: 2 inches.

2.4 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Analysis: Ascertain pH and percentage of nitrogen, phosphorus, potash, soluble salt content, and organic matter.

C. Provide recommendation for fertilizer and lime application rates for specified sod grass species based on testing.

D. Prior Tests:

1. Testing is not required if recent tests are available for imported topsoil.

2. Submit such test results to testing laboratory.
3. Indicate, based on test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that prepared soil base is ready to receive Work of this Section.

3.2 INSTALLATION

A. Subsoil Preparation:

1. Eliminate uneven areas and low spots.
2. Maintain indicated lines, levels, profiles, and contours.
3. Slopes:
 - a. Make gradual changes in grade.
 - b. Blend slopes into level areas.
4. Foreign Materials:
 - a. Remove foreign materials and undesirable plants and their roots.
 - b. Do not bury foreign materials beneath areas to be sodded.
5. Remove contaminated subsoil.
6. Scarify subsoil to depth of 4 inches where topsoil is to be placed.
7. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

B. Placing of Topsoil:

1. Spread topsoil to minimum depth of 3 inches over area to be sodded.
2. Place topsoil during dry weather and on dry unfrozen subgrade.
3. Remove vegetable matter and foreign nonorganic material from topsoil while spreading.
4. Grade topsoil to eliminate rough, low, or soft areas, and to ensure positive drainage.
5. Install edging at periphery of sodded areas in straight lines to consistent depth.

C. Fertilizing:

1. Apply lime at application rate recommended by soil analysis.
2. Work lime into top 6 inches of soil.
3. Apply fertilizer at application rate recommended by soil analysis.

4. Apply fertilizer after smooth raking of topsoil and prior to installation of sod.
5. Apply fertilizer no more than 48 hours before laying sod.
6. Mix fertilizer thoroughly into upper 4 inches of topsoil.
7. Lightly water soil to aid dissipation of fertilizer.

D. Laying of Sod:

1. Moisten prepared surface immediately prior to laying sod.
2. Lay sod within 24 hours after harvesting to prevent deterioration.
3. Joints:
 - a. Lay sod tightly with no open joints visible and no overlapping.
 - b. Stagger end joints minimum 12 inches.
 - c. Do not stretch or overlap sod pieces.
4. Lay smooth and align with adjoining grass areas.
5. Place top elevation of sod 1/2 inch below adjoining edging, paving and curbs.
6. Slopes:
 - a. On slopes 6 in./ft. and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet o.c.
 - b. If using "big roll," lay sod parallel to slope.
 - c. Drive pegs flush with soil portion of sod.
 - d. Prior to placing sod on slopes exceeding 8 in./ft., place wire mesh over topsoil and securely anchor wire mesh in place with wood pegs sunk firmly into ground.
7. Watering:
 - a. Water sodded areas immediately after installation.
 - b. Saturate sod to 4 inches of soil.
8. Rolling:
 - a. After sod and soil have dried, roll sodded areas to bond sod to soil and to remove minor depressions and irregularities.
 - b. Roll sodded areas with roller not exceeding 200 lb.
 - c. Roll before first watering.

3.3 MAINTENANCE

- A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance service.
- B. Maintain sodded areas immediately after placement until grass is well established and exhibits vigorous growing condition.
- C. Water to prevent grass and soil from drying out.
- D. Roll surface to remove irregularities.

- E. Weed Control:
 - 1. Control growth of weeds by applying herbicides.
 - 2. Remedy damage resulting from improper use of herbicides.
- F. Immediately replace sod on areas showing deterioration or bare spots.
- G. Protect sodded areas with warning signs during maintenance period.

END OF SECTION 329223

SECTION 331416 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for Site water line, including domestic water line and fire water line.
2. Tapping sleeves and valves.
3. Valves and boxes.
4. Fire hydrants and yard hydrants.
5. Reduced-pressure backflow preventers.
6. Pipe support systems.
7. Bedding and cover materials.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete for cradles and encasements.
2. Section 221100 - Facility Water Distribution: Product and execution requirements for domestic water piping at building.
3. Section 310513 - Soils for Earthwork: Soils for backfill in trenches.
4. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
5. Section 312316 - Excavation: Product and execution requirements for excavation and backfill.
6. Section 312316.13 - Trenching: Execution requirements for trenching.
7. Section 312323 - Fill: Requirements for backfill to be placed by this Section.
8. Section 330110.58 - Disinfection of Water Utility Piping Systems: Disinfection of water mains and appurtenances.
9. Section 330509.33 - Thrust Restraint for Utility Piping: Tied joint-restraint system to anchor and resist forces developed in underground closed pipeline systems.
10. Section 330563 - Concrete Vaults and Chambers: Cast-in-place, precast-concrete, or masonry structures for access to subsurface drainage piping or utilities.
11. Section 330577 - Fiberglass Metering Manholes: Fiberglass-reinforced plastic (FRP) valve vaults and meter boxes for valve and meter installations.
12. Section 330597 - Identification and Signage for Utilities: Pipe markers.
13. Section 331417 - Site Water Service Utility Laterals: Water main service connections.
14. Section 331419 - Valves and Hydrants for Water Utility Service: Fire hydrants, valves, and valve boxes for fire hydrant and water main installations.
15. Section 331900 - Water Utility Metering Equipment: Positive displacement meters as required by this Section.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

1.3 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.
3. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

- C. American Society of Sanitary Engineering:

1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

- D. ASTM International:

1. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
2. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).
3. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³).
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
5. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
7. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
8. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
9. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
10. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
11. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C200 - Steel Water Pipe, 6 In. (150 mm) and Larger.
6. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe.
7. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied.
8. AWWA C206 - Field Welding of Steel Water Pipe.
9. AWWA C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
10. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
11. AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
12. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
13. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
14. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
15. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
16. AWWA C606 - Grooved and Shouldered Joints.
17. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
18. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm) for Water Service.
19. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Waterworks.

F. American Welding Society:

1. AWS A5.8/ (A5.8M - Specification for Filler Metals for Brazing and Braze Welding).

G. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

H. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, valves and hydrants.

- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

- A. Valves: Mark valve body with manufacturer's name and pressure rating.
- B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience in installation of Work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Storage:
 - 1. Store materials according to manufacturer instructions.
 - 2. Block individual and stockpiled pipe lengths to prevent moving.
 - 3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
 - 4. Store PE and PVC materials out of sunlight.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

- A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five-year manufacturer's warranty for valves .

PART 2 - PRODUCTS

2.1 PIPING

A. Ductile Iron Pipe:

1. Comply with AWWA C151.
2. Fittings:
 - a. Material: Ductile iron.
 - b. Thickness: Standard.
3. Joints:
 - a. Comply with AWWA C111.
 - b. Provide rubber gasket with rods.
4. Jackets: AWWA C105 PE jacket.

B. Copper Tubing:

1. Comply with ASTM B88.
2. Type K, annealed.
3. Fittings: ASME B16.18, cast copper or ASME B16.22, wrought copper.
4. Joints: Compression connection or AWS A5.8/A5.8M, BCuP silver braze.

C. PVC Pipe:

1. Comply with AWWA C900, Class 165.
2. Fittings:
 - a. Material: Cast iron.
 - b. Comply with AWWA C111.
3. Joints:
 - a. Comply with ASTM D3139.
 - b. Furnish compression gasket ring.

2.2 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:

1. Manufacturers:
 - a. Furnish materials according to City of Shreveport Standards For Infrastructure Improvements, 2006 Edition.

B. Description:

1. Material: Ductile or cast iron.
2. Type: Dual compression.
3. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 125 and MSS SP-60.

C. Tapping Valves:

- a. Furnish materials according to City of Shreveport standards.

D. Description:

1. Comply with AWWA C500.
2. Type: Double disc with non-rising stem.
3. Inlet Flanges: Comply with ASME B16.1, Class 125, and MSS SP-60.
4. Mechanical Joint Outlets: Comply with AWWA C111.
5. Mark manufacturer's name and pressure rating on valve body.

2.3 VALVES AND HYDRANTS

- A. Valves, Valve Boxes, and Fire Hydrants: As specified in Section 331419 - Valves and Hydrants for Water Utility Service.

B. Yard Hydrants:

1. Description:

- a. Automatic-draining, non-freezing yard hydrant for hose connection.
- b. Inlet:
 - 1) Size: 1 inch NPT.
 - 2) Fitting: Female.
- c. Nozzle:
 - 1) Size: 3/4 inch.
 - 2) Material: Brass.
 - 3) Fitting: Male.
 - 4) Type: Removable.
- d. Casing:
 - 1) Description: Galvanized-steel pipe.
 - 2) Size: 1-1/4 inch.
- e. Drain Hole: Tapped, 1/8 inch NPT.
- f. Operating Rod:
 - 1) Description: Galvanized-steel pipe.
 - 2) Size: 3/8 inch.
- g. Working Pressure: 125 psig.

2.4 REDUCED-PRESSURE BACKFLOW PREVENTERS

A. Description:

- 1. Comply with ASSE 1013.
- 2. Materials:
 - a. Body: Bronze.
 - b. Internal Parts: Bronze.
 - c. Springs: Stainless steel.
- 3. Check Valves:
 - a. Quantity: Two.
 - b. Description: Independently operating, spring loaded.
 - c. Type: Diaphragm type, differential pressure relief, located between check valves.

- d. Provide third check valve opening under back pressure in case of diaphragm failure.
 - e. Vent Outlet: Non-threaded.
 - 4. Furnish two gate valves, one strainer, and four test cocks.
- B. Double Check Valve Assemblies:
 - 1. Comply with ASSE 1012.
 - 2. Description: Two independently operating check valves, with intermediate atmospheric vent.
 - 3. Materials:
 - a. Body: Bronze.
 - b. Internal Parts: Corrosion resistant.
 - c. Springs: Stainless steel.

2.5 CONCRETE ENCASEMENT AND CRADLES

- A. Concrete:
 - 1. As specified in Section 033000 - Cast-in-Place Concrete.
 - 2. Compressive Strength: 4,000 psi at 28 days.
 - 3. Finish: Rough troweled.
- B. Concrete Reinforcement: As specified in Section 032000 - Concrete Reinforcing.

2.6 MATERIALS

- A. Bedding and Cover:
 - 1. Bedding: Fill Type A1 as specified in Section 310516 - Aggregates for Earthwork.
 - 2. Cover: Fill Type A1 as specified in Section 310516 - Aggregates for Earthwork.
 - 3. Soil Backfill from Above Pipe to Finish Grade:
 - a. Soil Type S1 as specified in Section [310513 - Soils for Earthwork.

2.7 ACCESSORIES

- A. Thrust Restraints: As specified in Section 330509.33 - Thrust Restraint for Utility Piping.
- B. Air-Release Valves:
 - 1. As located on Drawings.
 - 2. As specified in Section 400578.11 - Air Release Valves for Water Service.

- C. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
- D. Vaults: As specified in Section 330563 - Concrete Vaults and Chambers.
- E. Metering Equipment: As specified in Section 331900 - Water Utility Metering Equipment.
- F. Meter Boxes: As specified in Section 330577 - Fiberglass Metering Manholes.
- G. Steel Rods, Bolt, Lugs, and Brackets:
 - 1. Comply with ASTM A36/A36M or A307.
 - 2. Grade A carbon steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare pipe connections to equipment with flanges or unions.
- E. Protect and support existing distribution piping and appurtenances as Work progresses.

3.3 INSTALLATION

- A. Bedding:
 - 1. Excavate pipe trench as specified in Section 312316.13 - Trenching.
 - 2. Placement:
 - a. Place bedding material as indicated on Drawings.

- b. Level fill materials in one continuous layer not exceeding 8 inches of compacted depth.
 - c. Compact to 95 percent maximum density.
 3. Place fill materials as specified in Section 312323 - Fill.

B. Pipe and Fittings:

1. Maintain separation of water main from sewer piping 6 feet minimum according to Louisiana State Sanitary Code.
 2. Group piping with other Site piping work whenever practical.
 3. Install pipe to elevations indicated on Drawings.
 4. Install ductile-iron piping and fittings according to AWWA C600.
 5. Route pipe in straight line.
 6. Install access fittings to permit disinfection of water system performed under Section 330110.58 - Disinfection of Water Utility Piping Systems.
 7. Thrust Restraints:
 - a. Form and place concrete for pipe thrust restraints at each elbow or change of pipe direction.
 - b. Place concrete to permit full access to pipe and pipe accessories.
 - c. Provide bearing area as indicated on Drawings.
 8. Establish elevations of buried piping with not less than five feet of cover.
 9. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
 10. Valves, Valve Boxes, and Fire Hydrants: As specified in Section 331419 - Valves and Hydrants for Water Utility Service.
- C. Meters and Boxes: As specified in Section 331900 - Water Utility Metering Equipment and Section 330577 - Fiberglass Metering Manholes.
- D. Disinfection: As specified in Section 330110.58 - Disinfection of Water Utility Piping Systems.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
 - B. Install pipe within tolerance of 5/8 inch.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
 - B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
 - C. Testing:

1. Pressure test piping system according to AWWA C600 and following:
 - a. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
 - b. Conduct hydrostatic test for a minimum of two hours.
 - c. Slowly fill section to be tested with water; expel air from piping at high points.
 - d. Install corporation cocks at high points.
 - e. Close air vents and corporation cocks after air is expelled.
 - f. Raise pressure to specified test pressure.
 - g. Observe joints, fittings, and valves under test.
 - h. Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage, and retest.
 - i. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
 - j. Maintain pressure within plus or minus 5 psi of test pressure.
 - k. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
 - l. Compute maximum allowable leakage using following formula:
 - 1) $L = SD \times \sqrt{P}/C$.
 - 2) L = testing allowance, gph.
 - 3) S = length of pipe tested, feet.
 - 4) D = nominal diameter of pipe, inches.
 - 5) P = average test pressure during hydrostatic test, psig.
 - 6) C = 148,000.
 - m. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
 - n. Leakage:
 - 1) If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
 - 2) Correct visible leaks regardless of quantity of leakage.
2. Compaction Testing:
 - a. Comply with ASTM D1557.
 - b. Frequency of Compaction Tests: One per 200 lineal feet..
 - c. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 331416

SECTION 333100 - SANITARY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewerage piping.
2. Bedding and cover materials.

B. Related Requirements:

1. Section 221300 - Facility Sanitary Sewerage: Product and execution requirements for sanitary waste and vent piping at building.
2. Section 310513 - Soils for Earthwork: Soil for backfill in trenches.
3. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
4. Section 312316 - Excavation: Requirements for excavation and backfill as required by this Section.
5. Section 312316.13 - Trenching: Requirements for trenching as required by this Section.
6. Section 312323 - Fill: Requirements for backfilling as required by this Section.
7. Section 330505.33 - Infiltration and Exfiltration Testing: Infiltration testing of gravity-flow sewerage piping.
8. Section 330505.43 - Mandrel Testing: Deflection testing of plastic sewerage piping.
9. Section 330561 - Concrete Manholes: Manholes for sanitary sewerage piping.

1.2 DEFINITIONS

- A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.

4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
7. AWWA C153 - Ductile-Iron Compact Fittings.

C. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
3. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric).
4. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
5. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).
6. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
7. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
8. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
9. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
10. ASTM C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals (Metric).
11. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
12. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
13. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
14. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
15. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
16. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
17. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
18. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
19. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

21. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.4 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information indicating pipe material to be used, pipe accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record finished locations of pipe runs, connections, manholes, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Storage:
 1. Store materials according to manufacturer instructions.
 2. Store valves in shipping containers with labeling in place.
- D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Provide additional protection according to manufacturer instructions.

1.8 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SANITARY SEWERAGE PIPING

A. Ductile-Iron Pipe:

1. Minimum Special Thickness Class: 50.
2. End Connections: Bell and spigot.
3. Outside Coating:
 - a. Type: Asphaltic.
 - b. Minimum Uniform Thickness: 1 mil.
 - c. Comply with AWWA C151.
4. Lining:
 - a. Cement mortar lined.
 - b. Comply with AWWA C104.
5. PE Encasement: Comply with AWWA C105.
6. Fittings:
 - a. Material: Ductile iron, Class 50 or greater.
 - b. Comply with AWWA C153.
 - c. Lining: Cement-mortar lined according to AWWA C104.
7. Coating:
 - a. Coat pipe and fittings exposed inside of structures with two coats of bituminous paint to achieve minimum dry film thickness of 12-14 mils per coat.
 - b. As specified in Section 099000 - Painting and Coating.
8. Joints:

- a. Rubber gasket joint devices.
- b. Comply with AWWA C111.

B. Plastic Pipe:

- 1. Material: PVC.
- 2. Comply with ASTM D3034, SDR-35.
- 3. Inside Nominal Diameter: 4 inches,
- 4. End Connections: Bell and spigot with rubber-ring-sealed gasket joint.
- 5. Fittings: PVC.
- 6. Joints:
 - a. Elastomeric gaskets.
 - b. Comply with ASTM F477.

2.2 MANHOLES

- A. As specified in Section 330561 - Concrete Manholes.

2.3 FLEXIBLE COUPLINGS

A. Description:

- 1. Material: Resilient, chemical-resistant, elastomeric PVC.
- 2. Attachment: Two Series-300 stainless-steel clamps, screws, and housings.

2.4 FLEXIBLE PIPE BOOTS FOR MANHOLE PIPE ENTRANCES

A. Description:

- 1. Material: EPDM.
- 2. Comply with ASTM C923.
- 3. Attachment: Series-300 stainless-steel clamp and hardware.

2.5 MATERIALS

A. Bedding and Cover:

- 1. Bedding: Fill Type A1, as specified in Section 310516 - Aggregates for Earthwork.
- 2. Cover: Fill Type A1, as specified in Section 310516 - Aggregates for Earthwork.
- 3. Soil Backfill from Above Pipe to Finish Grade:
 - a. Soil Type S1, as specified in Section 310513 - Soils for Earthwork.

- b. Subsoil with no rocks more than 6 inches in diameter, frozen earth, or foreign matter.

2.6 ACCESSORIES

- A. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.

2.7 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that trench cut excavation base is ready to receive Work of this Section.
- C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Correct over-excavation with coarse aggregate.
- C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
- D. Protect and support existing sewer lines, utilities, and appurtenances.
- E. Utilities:
 - 1. Maintain profiles of utilities.
 - 2. Coordinate with other utilities to eliminate interference.
 - 3. Notify Architect/Engineer if crossing conflicts occur.

3.3 INSTALLATION

- A. Bedding:

1. Excavate pipe trench as specified in Section 312316.13 - Trenching.
2. Place bedding material at trench bottom.
3. Level materials in continuous layer not exceeding 8 inches.
4. Maintain optimum moisture content of bedding material to attain required compaction density.

B. Piping:

1. Install pipe, fittings, and accessories according to ASTM D2321, and seal joints watertight.
2. Lay pipe to slope gradients as indicated on Drawings.
3. Begin at downstream end of system and progress upstream.
4. Bedding: As indicated on Drawings.
5. Lay bell-and-spigot pipe with bells upstream.
6. Backfill and compact as specified in Section 312316.13 - Trenching.
7. Do not displace or damage pipe when compacting.
8. Connect to building sanitary sewer outlet and municipal sewer system.
9. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
10. Install Site sanitary sewage system piping to within 5 feet of building, and connect to building sanitary waste system as specified in Section 221300 - Facility Sanitary Sewerage.

C. Manholes: As specified in Section 330561 - Concrete Manholes.

D. Backfilling: As specified in Section 312323 - Fill.

3.4 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Request inspection by Architect/Engineer prior to and immediately after placing bedding.

D. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Pipe Testing:

- a. Pressure Testing: As specified in Section 330505.31 - Hydrostatic Testing, 330505.41 - Air Testing.
 - b. Infiltration and Exfiltration Testing: As specified in Section 330505.33 - Infiltration and Exfiltration Testing.
 - c. Deflection Testing: As specified in Section 330505.43 - Mandrel Testing.
3. Compaction Testing:
- a. Comply with ASTM D1557.
 - b. Testing Frequency: 1 per 200 LF trench.

3.6 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
- C. Cap open ends of piping during periods of Work stoppage.

END OF SECTION 333100

SECTION 334200 - STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stormwater drainage piping.
2. Manholes.
3. Catch basins.
4. Cleanouts.
5. Concrete encasement and cradles.
6. Bedding and cover materials.

B. Related Requirements:

1. Section 032000 - Concrete Reinforcing: Reinforcement of concrete cradles.
2. Section 033000 - Cast-in-Place Concrete: Concrete type for catch basin base pad construction.
3. Section 221400 - Facility Storm Drainage: Requirements for storm drainage piping.
4. Section 310513 - Soils for Earthwork: Soils for backfill in trenches.
5. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
6. Section 310519.13 - Geotextiles for Earthwork: Geotextile filter fabric.
7. Section 312316 - Excavation: Product and execution requirements for excavation and backfill as required by this Section.
8. Section 312316.13 - Trenching: Execution requirements for trenching as required by this Section.
9. Section 312323 - Fill: Requirements for backfill to be placed under this Section.
10. Section 330505.33 - Infiltration and Exfiltration Testing: Infiltration testing of gravity-flow sewerage piping.
11. Section 330505.43 - Mandrel Testing: Deflection testing of plastic sewerage piping.
12. Section 330561 - Concrete Manholes: Manholes and accessories as required by this Section.
13. Section 330597 - Identification and Signage for Utilities: Underground pipe markers.
14. Section 334113 - Foundation Drainage: Termination of subdrainage tile system for connection to Work of this Section.
15. Section 334119 - Underslab Drainage: Termination of subdrainage tile system for connection to Work of this Section.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile butadiene styrene.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M036 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
2. AASHTO M196 - Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
3. AASHTO M218 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized), for Corrugated Steel Pipe.
4. AASHTO M245 - Standard Specification for Corrugated Steel Pipe, Polymer-Precoated, for Sewers and Drains.
5. AASHTO M246 - Standard Specification for Steel Sheet, Metallic-Coated and Polymer-Precoated, for Corrugated Steel Pipe.
6. AASHTO M252 - Standard Specification for Corrugated Polyethylene Drainage Pipe.
7. AASHTO M274 - Standard Specification for Steel Sheet, Aluminum-Coated (Type 2), for Corrugated Steel Pipe.
8. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
9. AASHTO M289 - Standard Specification for Aluminum-Zinc Alloy Coated Sheet Steel for Corrugated Steel Pipe.
10. AASHTO M294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
11. AASHTO T241 - Standard Method of Test for Helical Continuously Welded Seam Corrugated Steel Pipe.
12. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM A123/ (A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products).
3. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
5. ASTM B745/B745M - Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
6. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
7. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe [Metric].
8. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
9. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe [Metric].
10. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

11. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets [Metric].
12. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
13. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
14. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
15. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
16. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
17. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
18. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
19. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
21. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
22. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
23. ASTM F405 - Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.
24. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
25. ASTM F667/F667M - Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings.

1.4 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with termination of storm sewer connection outside building, trenching, connection to foundation drainage system and municipal sewer utility service.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information describing pipe, and pipe accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- D. Manufacturer Instructions: Submit special procedures required to install specified products.

1.6 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 STORM DRAINAGE PIPING

A. Reinforced Concrete Piping:

1. Pipe:
 - a. Comply with ASTM C76 (C76M), Class III, with Wall Type B.
 - b. Reinforcement: Mesh.
 - c. End Connections: Bell and spigot.
2. Fittings: Reinforced concrete.
3. Joints:
 - a. Comply with ASTM C443 (C443M).
 - b. Gaskets: Rubber, compression.

B. Corrugated PE Piping:

1. Pipe:
 - a. Comply with ASTM F405..
 - b. Type: Smooth interior.
 - c. Inside Nominal Diameter: As shown on drawings.
2. Fittings: PE.
3. Joints: Comply with ASTM F405.

2.2 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill Type A1, as specified in Section 310516 - Aggregates for Earthwork.
2. Cover: Fill Type A1, as specified in Section 310516 - Aggregates for Earthwork.
3. Soil Backfill from above Pipe to Finish Grade: Soil Type S1 as specified in Section 310513 - Soils for Earthwork.

2.3 ACCESSORIES

- A. Geotextile Filter Fabric: As specified in Section 310519.13 - Geotextiles for Earthwork.
- B. Underground Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that excavation base is ready to receive Work of this Section.
- C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Correct over-excavation with coarse aggregate.
- C. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Excavation and Bedding:
 - 1. Excavate trench to 12 inches below pipe invert, and as specified in Section 312316.13 - Trenching.
 - 2. Hand trim excavation for accurate placement of piping to indicated elevations.
 - 3. Place bedding material at trench bottom.
 - 4. Level materials in continuous layers not exceeding 8-inch compacted depth.
 - 5. Maintain optimum moisture content of bedding material to attain required compaction density.
 - 6. Level fill materials in continuous layers not exceeding 8 inches in depth, and compact to 95 percent maximum density.
- B. Piping:
 - 1. Pipe, Fittings, and Accessories: Comply with ASTM D2321.
 - 2. Seal joints watertight.
 - 3. Place pipe on minimum 4-inch- deep bed of filter aggregate.
 - 4. Install aggregate at sides and over top of pipe.
 - 5. Install top cover to minimum compacted thickness of 12 inches, and compact to 95 percent maximum density.
 - 6. Backfilling and Compaction:

- a. As specified in Section 312323 - Fill.
 - b. Do not displace or damage pipe while compacting.
7. Manholes: As specified in Section 330561 - Concrete Manholes.
 8. Connect to municipal storm sewer system and manholes.
 9. Pipe Markers: As specified in Section 330597 - Identification and Signage for Utilities.
 10. Connect to subdrainage tile system piping as specified in Section 334113 - Foundation Drainage and 334119 - Underslab Drainage.
 11. Connect to building storm drainage system as specified in Section 221400 - Facility Storm Drainage.

C. Catch Basins and Cleanouts:

1. Form bottom of excavation clean and smooth, and to indicated elevation.
2. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.
3. Level top surface of base pad.
4. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
5. Mount lid and frame level in grout, secured to top section to indicated elevation.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Maximum Variation from Indicated Pipe Slope: 1/8 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

- A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Testing:
 1. Compaction Test:
 - a. Comply with ASTM D1557.
 - b. Testing Frequency: 1 per 200 lf of trench.
 2. Manholes: As specified in Section 330561 - Concrete Manholes.
 3. Piping:
 - a. Infiltration and Exfiltration Testing: As specified in Section 330505.33 - Infiltration and Exfiltration Testing.
 - b. Deflection Testing: As specified in Section 330505.43 - Mandrel Testing.

4. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.

3.6 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 334200

SECTION 334213 - STORMWATER CULVERTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete box sections.
2. Bedding and cover materials.

B. Related Requirements:

1. Section 032000 - Concrete Reinforcing: Reinforcement of concrete cradles.
2. Section 033000 - Cast-in-Place Concrete: Encasement and cradles.
3. Section 036000 - Grouting: Cementitious grout fill for pipe ends.
4. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
5. Section 310519.13 - Geotextiles for Earthwork: Geotextile fabric for subdrainage.
6. Section 312316.13 - Trenching: Excavating and backfilling for culvert piping.
7. Section 312323 - Fill: Backfilling.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO M36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
2. AASHTO M86/M86M - Standard Specification for Nonreinforced Concrete, Sewer, Storm Drain, and Culvert Pipe.
3. AASHTO M170 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. AASHTO M170M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe [Metric].
5. AASHTO M196 - Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains.
6. AASHTO M206/M206M - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
7. AASHTO M207/ (M207M - Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe).
8. AASHTO M252 - Standard Specification for Corrugated Polyethylene Drainage Pipe.
9. AASHTO M259 - Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.
10. AASHTO M259M - Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers [Metric].

11. AASHTO M273 - Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 ft of Cover Subjected to Highway Loadings.
12. AASHTO M273M - Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 ft of Cover Subjected to Highway Loadings [Metric].
13. AASHTO M278 - Standard Specification for Class PS46 Poly(Vinyl Chloride) (PVC) Pipe.
14. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
15. AASHTO M294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
16. AASHTO M304 - Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter.
17. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM A123/ (A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products).
2. ASTM A760/ (A760M - Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains).
3. ASTM B745/ (B745M - Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains).
4. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
5. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe [Metric].
6. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
7. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe [Metric].
8. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
9. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets [Metric].
10. ASTM C506 - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
11. ASTM C506M - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe [Metric].
12. ASTM C507 - Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
13. ASTM C507M - Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe [Metric].
14. ASTM C1433 - Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers.

15. ASTM C1433M - Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers [Metric].
16. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
17. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
18. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with termination of storm sewer, trenching and connection to public storm sewer.

1.4 PREINSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information regarding pipe, fittings, and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit special procedures required to install specified products.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. Qualifications Statement:
 1. Submit qualifications for manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Storage:
 - 1. Store materials according to manufacturer instructions.
 - 2. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
 - 3. Do not store pipe flat on ground.
 - 4. Store UV-sensitive materials out of direct sunlight.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Block individual and stockpiled pipe lengths to prevent moving.
 - 3. Cradle pipe to prevent point stress.
 - 4. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PIPE CULVERT

- A. Reinforced Non-Circular Concrete Pipe:
 - 1. Precast Concrete Box Sections:
 - a. Comply with ASTM C1433 (C1433M).

- b. Joints: Comply with ASTM C1433 (C1433M).

2.2 ACCESSORIES

- A. Geotextile Filter Fabric: As specified in Section 310519.13 - Geotextiles for Earthwork.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that trench cut excavation base is ready to receive Work of this Section.
- C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Correct over-excavation with coarse aggregate.
- C. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Excavation and Bedding:
 - 1. Excavate culvert trench to 12 inches below pipe invert, and as specified in Section 312316 – Excavation and 312316.13 - Trenching.
 - 2. Hand trim excavation for accurate placement of piping to indicated elevations.
 - 3. Place bedding material at trench bottom.
 - 4. Maintain optimum moisture content of bedding material to attain required compaction density.
 - 5. Level fill materials in continuous layers not exceeding 8 inches in depth, and compact to 95 percent maximum density.
- B. Culvert:
 - 1. Positioning:
 - a. Lift or roll culvert into position; do not drop or drag culvert over prepared bedding.

- b. Shore culvert to required position, and retain in place until after compaction of adjacent fills.

2. Backfilling and Compaction:

- a. As specified in Section 312323 - Fill.
- b. Level fill materials in continuous layers not exceeding 8 inches in depth, and compact to 95 percent maximum density.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Maximum Variation from Indicated Slope: 1/8 inch in 10 feet.
- C. Maximum Variation from Intended Elevation of Culvert Invert: 1/2 inch.
- D. Maximum Offset of Pipe from Indicated Alignment: 1 inch.
- E. Maximum Variation in Profile of Structure from Intended Position: 1.0 percent.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. Compaction Testing:
 - 1. Comply with ASTM D1557.
 - 2. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
 - 3. Testing Frequency: 1 per lift per 200 lf.

3.6 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect culvert and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION 334213

SECTION 412200 – OVERHEAD TRAVELING CRANE SYSTEMS**PART 1 – GENERAL****1.01 SUMMARY**

- A. This Section includes furnishing and installing a complete electrically operated bridge crane system, including bridge girders, end trucks, trolley, hoist, electrical controls, cabling, and accessories.
- B. Runway beams, supports, and incoming power feed are provided under other sections.
- C. Coordinate installation requirements with structural and electrical trades.

1.02 REFERENCES

- A. The following standards form a part of this specification:
 - 1. OSHA 1910.179 and 1926.554 – Overhead and Gantry Cranes.
 - 2. CMAA Specification No. 70 – Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes.
 - 3. ASME/ANSI B30.2 – Overhead and Gantry Cranes.
 - 4. ASME/ANSI B30.16 – Overhead Hoists.
 - 5. ASME/ANSI HST-4 – Performance Standard for Overhead Electric Wire Rope Hoists.
 - 6. NFPA 70 (NEC) – Articles 430 and 610.
 - 7. AWS D1.1 – Structural Welding Code.
 - 8. AISC – Manual of Steel Construction.
 - 9. NEMA MG-1 – Motors and Generators.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's catalog data, technical sheets, motor data, duty ratings, and finishes.
- B. Shop Drawings: Include general arrangement, dimensions, weights, clearances, hook approach, and runway reactions.
- C. Certificates: Certify compliance with CMAA Class C and ASME H4 requirements.
- D. Operation and Maintenance Manuals: Include operating procedures, lubrication, adjustment, and spare parts list.
- E. Factory and Field Test Reports: Submit certified test results verifying compliance.

1.04 QUALITY ASSURANCE

- A. Manufacturer: OMi Crane Systems, Inc.
- B. Approved Equals: Konecranes; Demag.
- C. Hoist Manufacturer: R&M Materials Handling, Inc., Spacemaster SX Series.
- D. Equipment shall be designed and fabricated to CMAA Class "C" service duty and ASME H4 hoist classification.
- E. All electrical components shall be UL listed or CSA certified.
- F. All welding shall conform to AWS D1.1.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment in manufacturer's original packaging with identification labels intact.
- B. Store under cover, protected from weather, moisture, and physical damage.

1.06 WARRANTY

- A. Provide manufacturer's standard one-year warranty covering materials and workmanship.
-

PART 2 – PRODUCTS**2.01 MANUFACTURERS**

- A. Basis of Design: OMi Crane Systems, Model AFJMC 5-Ton × 60'-2" span.
- B. Approved Equals: Konecranes; Demag; Deshazo; Bridge Crane Specialists or approved equivalent meeting all performance and dimensional requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Rated Capacity: 5 tons.
- B. Span: 60 feet, 2 inches.
- C. Lift Height: 21 feet, 1 inch minimum.
- D. Crane Classification: CMAA Class C.
- E. Hoist Group: ASME H4.
- F. Operation: Electrically operated, pendant controlled from independent track.
- G. Hoisting Speed: 20 feet per minute high speed; 3.2 feet per minute low speed (two-speed).
- H. Trolley Speed: 65 feet per minute, variable frequency drive (VFD).
- I. Bridge Travel Speed: 100 feet per minute, variable frequency drive (VFD).
- J. Static Wheel Load: Maximum 8,000 pounds per wheel.
- K. Power Supply: 460 volts, 3-phase, 60 hertz; 115-volt control circuit.
- L. Total Power: Approximately 8.9 horsepower.
- M. Operating Temperature: 32°F to 104°F, indoor use only.

2.03 MATERIALS

- A. Bridge Girder: ASTM A36 or A992 structural steel, welded box or wide-flange section.
- B. End Trucks: Fabricated steel construction per CMAA 70; bolted to bridge girder.
- C. Wheels: Heat-treated steel or ductile iron with anti-friction bearings.
- D. Hooks: Forged alloy steel with spring-loaded safety latch.
- E. Fasteners: ASTM A325 or equivalent.

2.04 HOIST AND TROLLEY

- A. Type: Electric wire rope hoist, single-reeved, low headroom.
- B. Load Limit Device: Prevents lifting more than 110% of rated capacity.
- C. Motors: Squirrel-cage induction type, two-speed; Class F insulation; IP55 enclosure.
- D. Brake: DC disc type capable of holding 125% of rated load.
- E. Drum: Grooved steel drum, minimum 36:1 drum-to-rope diameter ratio; equipped with rope guide.
- F. Wire Rope: Galvanized steel, 5:1 minimum safety factor.

- G. Limit Switches: Rotary cam type with upper, lower, and slowdown functions.
- H. Trolley Drive: VFD control for smooth acceleration and deceleration.
- I. Trolley Motors: Inverter-duty, TENV enclosures.
- J. Nameplate: Show manufacturer, model, serial number, capacity, and date of manufacture.

2.05 BRIDGE DRIVE AND END TRUCKS

- A. Dual-motor (CMAA A-4) drive arrangement.
- B. Motors: Inverter-duty, Class F, TENV.
- C. Drive Control: Variable frequency inverter for stepless control.
- D. Bumpers: Energy-absorbing rubber bumpers at each end.
- E. Rail Sweeps and Drop Lugs: Provide on all end trucks.
- F. Gearing: AGMA Class 10 precision-ground, semi-fluid grease lubrication.
- G. Limit Switches: Provide as required for safe operation.

2.06 POWER SUPPLY AND CONTROLS

- A. Main Power: 460 volts, 3-phase, 60 Hz; 115-volt control circuit.
- B. Runway Electrification: 4-bar insulated conductor system by Insul-8, Duct-O-Wire, or Wampfler.
- C. Bridge Power: Flat-cable festoon system with track, carriers, and terminal boxes.
- D. Controls: Pendant push-button station with Start and Emergency Stop; six-way operation.
- E. Enclosures: NEMA 4 / IP55 minimum; pendant NEMA 4X / IP65.
- F. Provide radio control option if requested by Owner.

2.07 FINISHES

- A. Factory clean, prime, and paint all exposed crane components.
 - B. Standard Finish: Safety Yellow, AKRYL system with 127-micron dry film thickness.
 - C. **Final Color:** All exposed crane components shall be painted **a color selected by the Architect.**
 - D. Do not paint hoist wire rope, conductor bars, wheels, or running surfaces.
-

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify runway beams, supports, and clearances are in accordance with approved shop drawings and manufacturer's tolerances before installation.
- B. Report nonconforming conditions to the Architect prior to proceeding.

3.02 INSTALLATION

- A. Install crane and hoist in accordance with manufacturer's instructions and CMAA Specification 70.
- B. Align rails, end stops, and bumpers for smooth operation.
- C. Connect power supply and controls per NEC and manufacturer's diagrams.

3.03 FIELD TESTING

- A. Operate hoist, trolley, and bridge through full range of travel to ensure proper operation.
- B. Perform load test at 125% of rated capacity per ASME B30.2.

- C. Submit written certification of test results to Architect.
- D. Train Owner's personnel in operation and maintenance procedures.

3.04 CLEANING AND PROTECTION

- A. Clean painted surfaces and touch up any marred areas.
- B. Protect crane system from damage until final acceptance.

END OF SECTION 412200