PROJECT MANUAL

PROJECT NO. 10238.00

18 May 2022

A New Worship Facility

FOR

Tabernacle Baptist Church

Selma, Alabama





<u>exford</u> ARCHITECTS

3929 Jefferson Avenue Southwest Birmingham, Alabama 35221 Telephone: 205.957.6640 www.exfordllc.com



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DOCUMENT 00 11 16 – INVITATION TO BID

1.1 PROJECT INFORMATION

- A. Notice to Bidders: Qualified bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.
- B. Project Identification: A New Worship Facility for Tabernacle Baptist Church, Architectural Project Number 10238.00.
 - 1. Project Location: 1500 Block of Broad Street, Selma, Alabama 36701.
- C. Owner: Tabernacle Baptist Church, 1431 Broad Street, Selma, Alabama 36701.
 - 1. Owner's Representative: Dr. Otis Dion Culliver.
- D. Architect: Exford Architects, Attn: Fredrick Woods, 3928 Jefferson Avenue, SW, Birmingham, Alabama 35221, (205) 957-6640.
- E. Project Description: Project consists of a replacement "Church" building containing a Sanctuary with balcony, classrooms, split HVAC system, toilets, administrative offices, nursing mothers room, audio/visual room and ursher's room.
- F. Construction Contract: Bids will be received for the following Work:
 - 1. General Contract (all trades).

1.2 BID SUBMITTAL AND OPENING

- A. Owner will receive sealed bids until the bid time and date at the location indicated below that are prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:
 - 1. Bid Date: Thursday, 14 July 2022.
 - 2. Bid Time: 5:00 p.m., local time.
 - 3. Location: Tabernacle Baptist Church Fellowship Hall on basement floor, 1431 Broad Street, Selma, Alabama 36701.
- B. Bids will be thereafter opened in the presence of the bidders and read aloud.

DOCUMENT 00 11 16 - INVITATION TO BID

1.3 BID SECURITY

A. Bid security shall be submitted with each bid in the amount of 5 percent of the bid amount. No bids may be withdrawn for a period of 60 days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

1.4 PREBID CONFERENCE

A. A Prebid conference for all bidders will be held at Tabernacle Baptist Church, 1431 Broad Street, Selma, Alabama 36701 on Thursday, 07 July 2022 at 5:00 p.m., local time. Prospective bidders are required to attend.

1.5 DOCUMENTS

A. Online Procurement and Contracting Documents: Obtain access after Tuesday, 07 June 2022 by contacting Architect, or ARC Documents Solutions, LLC, 3104-4th Avenue South, Birmingham, Alabama 35233, (205) 323-1563. Online access will be provided to all registered bidders and suppliers.

1.6 TIME OF COMPLETION

A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time of 365 Calendar Days.

1.7 BIDDER'S QUALIFICATIONS

A. Bidders must be properly licensed general contractors under the laws governing their respective trades in the State of Alabama and the City of Selma Alabama and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

END OF DOCUMENT 00 11 16

A NEW WORSHIP FACILITY FOR TABERNACLE BAPTIST CHURCH SELMA, ALABAMA PROJECT NUMBER 10238.00

NOTICE TO ALL CONTRACTORS

Page 1 of 1

- The complete set of Contract Documents for this Work consists of one volume of Drawings and one volume of Specifications and all Addenda. These volumes must not be separated by anyone for any reason. The Architect and the Owner disclaim any responsibility for assumptions made by a Contractor, Subcontractors, or other parties who do not receive a complete set of Specifications including all Sections listed in the Table of Contents and Drawings including all sheets listed in the Index of Drawings.
- 2. The Construction period shall be (365) three hundred sixty-five calendar days from the Notice to Proceed.
- 3. Fire alarm device installation shall be performed by a fire alarm contractor permitted by the State of Alabama Fire Marshal's Office.
- 4. Test the fire alarm system prior to substantial completion and an NFPA 72 "Record of Completion" shall be provided upon final inspection.
- 5. The contractor shall conduct a Pre-Roofing Conference at the job site prior to the start of roofing installation. The conference shall be attended by the following:
 - a. The general contractors' superintendent.
 - b. The Architects' Project Manager.
 - c. Roofing Manufacturer's Representative.
 - d. Roofing Subcontractor.

A copy of the roof warranty must be presented at the Pre-Roofing Conference by the roofing manufacturer. The warranty must be based on the laws of the State of Alabama.

AIA Document A701⁻ – 2018

Instructions to Bidders

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

A New Worship Facility for Tabernacle Baptist Church Selma, Alabama

THE OWNER:

(Name, legal status, address, and other information)

Tabernacle Baptist Church 1431 Broad Street Selma, Alabama 36701

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

Exford, LLC 3928 Jefferson Avenue, SW Birmingham, Alabama 35221

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- 1 DEFINITIONS
- 2 BIDDER'S REPRESENTATIONS
- 3 BIDDING DOCUMENTS
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- 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

ADDITIONS AND DELETIONS:

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

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

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

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

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ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

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

ARTICLE 3 **BIDDING DOCUMENTS**

§ 3.1 Distribution

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

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

A link to an electronic copy of bid documents may be obtained by emailing the Architect's Project Manager, Fredrick Woods at fredrickwoods@exfordllc.com. Hard copies may be purchased directly from ARC Documents Solutions, LLC, 3104-4th Avenue South, Birmingham, Alabama 35233, (205) 323-1563.

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

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

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

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids. (Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

Email project related questions on AIA Document G716-2004 - REQUEST FOR INFORMATION to the Architect's Project Manager at fredrickwoods@exfordllc.com.

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

§ 3.3 Substitutions

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

§ 3.3.2 Substitution Process

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

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

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

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

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

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

§ 3.4 Addenda

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

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

via contractor's email address on file.

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

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to

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

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security: (Insert the form and amount of bid security.)

Bid Bond or Certified Check where amount shall not exceed 5% of the bid amount or ten thousand dollars, whichever is less.

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should

the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

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

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

§ 4.3 Submission of Bids

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

Prospective contractors shall submit a hard copy of bid on form provided in person at the location and time specified in the Invitation to Bid.

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

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

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

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

§ 4.4 Modification or Withdrawal of Bid

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

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

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

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

Bid bond documentation shall be returned within ten (10) calendar days from the date all parties agree that a legitimate error was made.

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ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

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

§ 5.2 Rejection of Bids

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

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

- a designation of the Work to be performed with the Bidder's own forces; .1 .2
- names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each: and .3
- names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

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

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

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

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ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

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

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

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

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

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

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

.1 AIA Document A101[™]-2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.

(Insert the complete AIA Document number, including year, and Document title.)

- .2 AIA Document A101[™]–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below. (Insert the complete AIA Document number, including year, and Document title.)
- .3 AIA Document A201[™]–2017, General Conditions of the Contract for Construction, unless otherwise stated below. (Insert the complete AIA Document number, including year, and Document title.)
- .4 AIA Document E203[™]-2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below: (Insert the date of the E203-2013.)

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.5 Drawings

	Number See Index of Drawings	Title	Date	
.6	Specifications			
	Section See Table of Contents	Title	Date	Pages
.7	Addenda:			
	Number Acknowledge Number on Bid Form	Date	Pages	
.8	Other Exhibits: (Check all boxes that apply and inclu	de appropriate information i	dentifying the exh	ibit where required.)
	[] AIA Document E204 TM -201 TM (Insert the date of the E204-2	7, Sustainable Projects Exhib 2017.)	it, dated as indica	ted below:
	[] The Sustainability Plan:			
	Title	Date	Pages	
	[] Supplementary and other Con	ditions of the Contract:		
	Document	Title	Date	Pages

.9 Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

AIA Document A101° – 2017

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

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

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

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

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

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

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:

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

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

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

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TABLE OF ARTICLES

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- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

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

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

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

- [] The date of this Agreement.
- [] A date set forth in a notice to proceed issued by the Owner.
- [] Established as follows:

(Insert a date or a means to determine the date of commencement of the Work.)

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

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

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work: (Check one of the following boxes and complete the necessary information.)

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

[] By the following date:

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

Substantial Completion Date

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

ARTICLE 4 CONTRACT SUM

Portion of Work

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

§ 4.2 Alternates

Item

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

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

Price

 Item
 Price
 Conditions for Acceptance

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

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

Item

§ 4.6 Other:

Units and Limitations

Price per Unit (\$0.00)

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

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

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

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

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

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

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

§ 5.1.6 In accordance with AIA Document A201TM-2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

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

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to completed work, stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

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

- .1 The aggregate of any amounts previously paid by the Owner;
- 2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

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§ 5.1.7.1.1 The following items are not subject to retainage:

(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:

(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

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

(Insert any other conditions for release of retainage upon Substantial Completion.)

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

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

§ 5.2 Final Payment

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

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

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

§ 5.3 Interest

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

%

ARTICLE 6 DISPUTE RESOLUTION § 6.1 Initial Decision Maker

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

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§ 6.2 Binding Dispute Resolution

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

- [] Arbitration pursuant to Section 15.4 of AIA Document A201–2017
- [] Litigation in a court of competent jurisdiction
- [] Other (Specify)

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

ARTICLE 7 TERMINATION OR SUSPENSION

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

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

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

ARTICLE 8 MISCELLANEOUS PROVISIONS

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

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

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

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

§ 8.5 Insurance and Bonds

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

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

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201-2017, may be given in accordance with AIA Document E203[™]-2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203-2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- AIA Document A101[™]-2017, Standard Form of Agreement Between Owner and Contractor .1
- .2 AIA Document A101TM-2017, Exhibit A, Insurance and Bonds .3
- AIA Document A201TM-2017, General Conditions of the Contract for Construction
- AIA Document E203[™]-2013, Building Information Modeling and Digital Data Exhibit, dated as .4 indicated below:

(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

	Number	Title	Date	
.6	Specifications			
	Section	Title	Date	Pages
7	Addenda, if any:			
	Number	Date	Pages	

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

.8 Other Exhibits:

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

[] AIA Document E204TM-2017, Sustainable Projects Exhibit, dated as indicated below: (Insert the date of the E204-2017 incorporated into this Agreement.)

[] The Sustainability Plan:

	Title		Date	Pages	
[]	Supplementary and other C	onditions of the Co	ontract:	
	Docu	ment	Title	Date	Pages

.9 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201TM_2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

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

OWNER (Signature)

CONTRACTOR (Signature)

(Printed name and title)

(Printed name and title)

AIA Document A201° – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

A New Worship Facility for Tabernacle Baptist Church 1431 Broad Street Selma, Alabama 36701

THE OWNER: (Name, legal status and address)

Tabernacle Baptist Church 1431 Broad Street Selma, Alabama 36701

THE ARCHITECT: (Name, legal status and address)

Exford Architects 3928 Jefferson Avenue, SW Birmingham, Alabama 35221

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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.

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14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 **CLAIMS AND DISPUTES**

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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.

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§ 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

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§ 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 E203TM–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 E203TM_2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document
G202TM–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 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 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.

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§ 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 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 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.

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§ 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 Scapacity 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 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, 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.

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§ 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.

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§ 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

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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

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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.

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§ 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.

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§ 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 submittal 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.

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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 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

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§ 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

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§ 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 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

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§ 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

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

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

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reasons for withholding certification and Owner of the Architect's reasons for Payment, and notify the Contractor and Owner of the Architect's reasons for Section 9.5.1; or (3) withhold 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

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§ 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 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.

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§ 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

- liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled; .1
- .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

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§ 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 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

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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

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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.

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§ 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 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

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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 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.

§ 12.2.3 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.

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§ 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 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.

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§ 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

- repeatedly refuses or fails to supply enough properly skilled workers or proper materials; .1
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful .3 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:

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

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

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- .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.

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§ 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

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§ 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 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.

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§ 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.

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§ 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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MAIA[®] Document G702[™] – 1992

Application and Certificate for Payment

TO OWNER:	PROJECT:		APPLICATION NO: 001	Distribution to:
			CONTRACT FOR: General Construction	
FROM	VIA		CONTRACT DATE:	
CONTRACTOR:	ARCHITECT:		PROJECT NOS: / /	CONTRACTOR:
				FIELD:
				OTHER:
CONTRACTOR'S APPLICATION FO	RPAYMENT		The undersigned Contractor certifies that to the best of the Contractor	or's knowledge, information
Application is made for payment, as shown below, in	connection with the Contract.		and belief the Work covered by this Application for Payment has be with the Contract Documents, that all amounts have been paid by t	en completed in accordance be Contractor for Work for
Continuation Sheet, AIA Document G703, is attached	d.		which previous Certificates for Payment were issued and payments re	ceived from the Owner, and
1. ORIGINAL CONTRACT SUM	\$ <u></u>	0.00	that current payment shown herein is now due.	
2. NET CHANGE BY CHANGE ORDERS	\$	0.00	CONTRACTOR:	
3. CONTRACT SUM TO DATE (Line 1 ± 2)	\$	0.00	By: Date	:
4. TOTAL COMPLETED & STORED TO DATE (Column	G on G703) \$	0.00	State of:	
5. RETAINAGE:			County of:	
a. 0 % of Completed Work			Subscribed and sworn to before	
(Column $D + E$ on $G703$)	\$0.00		me this day of	
b. 0 % of Stored Material				
(Column F on G703)	\$0.00		Notary Public:	
Total Retainage (Lines 5a + 5b or Total in Column	n I of G703) \$	0.00	My Commission expires:	
6. TOTAL EARNED LESS RETAINAGE	\$	0.00	ARCHITECT'S CERTIFICATE FOR PAYMENT	
(Line 4 Less Line 5 Total)			In accordance with the Contract Documents, based on on-site observati	ions and the data comprising
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT		0.00	this application, the Architect certifies to the Owner that to the best of information and belief the Work has progressed as indicated the	the Architect's knowledge, quality of the Work is in
(Line 6 from prior Certificate)			accordance with the Contract Documents, and the Contractor is	entitled to payment of the
8. CURRENT PAYMENT DUE	\$	0.00	AMOUNT CERTIFIED.	
9. BALANCE TO FINISH, INCLUDING RETAINAGE			AMOUNT CERTIFIED	\$0.00
(Line 3 less Line 6)	\$0.00		(Attach explanation if amount certified differs from the amount applied Application and on the Continuation Sheet that are changed to conform	l. Initial all figures on this n with the amount certified.)
CHANGE ORDER SUMMARY	ADDITIONS DEDUC	TIONS	ARCHITECT:	
Total changes approved in previous months by Owne	er \$ 0.00 \$	0.00	By: Date	
Total approved this Month	\$ 0.00 \$	0.00	This Certificate is not negotiable. The AMOUNT CERTIFIED is pay	vable only to the Contractor
TOTALS	\$ 0.00 \$	0.00	named herein. Issuance, payment and acceptance of payment are with	out prejudice to any rights of
NET CHANGES by Change Order	\$	0.00	the Owner or Contractor under this Contract.	

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Continuation Sheet

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT,

containing Contractor's signed certification is attached.

In tabulations below, amounts are stated to the nearest dollar.

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

APPLICATION NO: 001

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

Α	В	С	D	E	F	G		Н	Ι
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK CO FROM PREVIOUS APPLICATION	MPLETED THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE	% (G÷C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
			(D + E)		,	(D+E+F)			
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
		0	0	0	0	0	0.00 %	0	0
	GRAND TOTAL	\$0	\$0	\$0	\$0	\$0	0.00 %	\$0	\$0

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■AIA[®] Document A310[™] – 1970

Bid Bond

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

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

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

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

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

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this day of ,

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.

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

Additions and Deletions Report for AIA° Document $A310^{\circ} - 1970$

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

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There are no differences.

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(Signed)		
(Title)	 	
(1000)		
(Dated)		

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Performance Bond

CONTRACTOR (Name, Legal Status and Address):

SURETY (Name, Legal Status and Principal Place of Business):

OWNER (Name, Legal Status and Address):

CONSTRUCTION CONTRACT Date:

Amount: \$ Description (Name and Location):

BOND

Date (Not earlier than Construction Contract Date): Amount: \$ Modifications to this Bond: None

CONTRACTOR AS PRINCIPAL

Company: (Corporate Seal)

SURETY Company:

Signature:

Name and

Title:

(Corporate Seal)

See Section 13

ADDITIONS AND DELETIONS:

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

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

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

Signature: Name and Title:

(Any additional signatures appear on the last page)

(FOR INFORMATION ONLY - Name, Address and Telephone)
AGENT or BROKER:
OWNER'S REPRESENTATIVE

(Architect, Engineer or other party):

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

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except to participate in conferences as provided in Section 3.1.

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

§ 3.1 The Owner has notified the Contractor and the Surety at its address described in Section 10 below that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Construction Contract. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default; and

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

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

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

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

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

§ 4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and the contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 6 in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor's default; or

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

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as
- practicable after the amount is determined, tender payment therefor to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner citing reasons therefor.

§ 5 If the Surety does not proceed as provided in Section 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 4.4, and the Owner refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 6 After the Owner has terminated the Contractor's right to complete the Construction Contract, and if the Surety elects to act under Section 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. To the limit of the amount of this Bond, but subject to commitment by the Owner of the Balance of the Contract Price to mitigation of costs and damages on the Construction Contract, the Surety is obligated without duplication for:

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

§ 6.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 4; and

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

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

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

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

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

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

§ 12 DEFINITIONS

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

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

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

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

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§ 13 MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.) **CONTRACTOR AS PRINCIPAL** SURETY Company: (Corporate Seal) Company: (Corporate Seal)

Signature: Name and Title: Address:

Signature: Name and Title: Address:

Additions and Deletions Report for AIA° Document $A312^{TM} - 1984$

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(Signed)		
(Title)	 	

(Dated)

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List of Subcontractors

PROJECT: (Name and address)

DATE:

TO ARCHITECT: (Name and address)

ARCHITECT'S PROJECT NUMBER:

FROM CONTRACTOR: (Name and address)

CONTRACTOR'S PROJECT NUMBER:

(List Subcontractors and others proposed to be employed on the above Project as required by the bidding documents.)

Work/Firm Name

Address/Phone

Superintendent

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▲IA[®] Document G710[™] – 1992

Architect's Supplemental Instructions

PROJECT (Name and address):	ARCHITECT'S SUPPLEMENTAL	OWNER:
		ARCHITECT:
OWNER (Name and address):	DATE OF ISSUANCE:	CONSULTANT: 🗌
	DATE OF ISOSANGE.	CONTRACTOR:
	CONTRACT FOR: General Construction	FIELD:
FROM ARCHITECT (Name and address):	CONTRACT DATE:	OTHER:

TO CONTRACTOR (Name and address):

ARCHITECT'S PROJECT NUMBER:

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

DESCRIPTION:

ATTACHMENTS: (Here insert listing of documents that support description.)

ISSUED BY THE ARCHITECT:

(Signature)

(Printed name and title)

AIA[°] Document G716[°] – 2004

Request for Information ("RFI")

	FROM:	
PROJECT:	ISSUE DATE:	RFI No. 001
PROJECT NUMBERS: /	REQUESTED RE COPIES TO:	EPLY DATE:
RFI DESCRIPTION: (Fully describ	be the question or type of information requ	ested.)
REFERENCES/ATTACHMENTS: SPECIFICATIONS:	(List specific documents researched when DRAWINGS:	seeking the information requested.) OTHER:
SENDER'S RECOMMENDATI	ON: (If RFI concerns a site or constructio	n condition, the sender may provide a
ecommended solution, including	g cost and/or schedule considerations.)	
RECEIVER'S REPLY: (Provide of	unswer to RFI, including cost and/or sched	lule considerations.)
RECEIVER'S REPLY: (Provide of	answer to RFI, including cost and/or sched	lule considerations.)
RECEIVER'S REPLY: (Provide of	answer to RFI, including cost and/or sched	lule considerations.)
RECEIVER'S REPLY: (Provide of an and a second secon	answer to RFI, including cost and/or schea	ule considerations.)

change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.

▲IA[®] Document G714[™] – 2007

Construction Change Directive

PROJECT : (Name and address)	DIRECTIVE NUMBER: DATE:	OWNER:
	CONTRACT FOR: General Construction	ARCHITECT:
TO CONTRACTOR: (Name and address)	CONTRACT DATED:	CONSULTANT:
	ARCHITECT'S PROJECT NUMBER:	CONTRACTOR:
		FIELD:
		OTHER:

You are hereby directed to make the following change(s) in this Contract: (Describe briefly any proposed changes or list any attached information in the alternative)

PROPOSED ADJUSTMENTS 1.

- The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:
 - ☑ •Lump Sum decrease of \$0.00
 - □ Unit Price of \$ per
 - □ As provided in Section 7.3.3 of AIA Document A201-2007
 - As follows:

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

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

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

ARCHITECT (Firm name)	OWNER (Firm name)	CONTRACTOR (Firm name)
ADDRESS	ADDRESS	ADDRESS
BY (Signature)	BY (Signature)	BY (Signature)
(Typed name)	(Typed name)	(Typed name)
DATE	DATE	DATE

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AIA[°] Document G701[°] – 2017

Change Order

Contract For: General Construction Date:	Change Order Number: 001 Date:
ARCHITECT: (Name and address)	CONTRACTOR: (Name and address)
	Contract For: General Construction Date: ARCHITECT: (Name and address)

THE CONTRACT IS CHANGED AS FOLLOWS:

(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original Contract Sum was	\$ 0.00
The net change by previously authorized Change Orders	\$ 0.00
The Contract Sum prior to this Change Order was	\$ 0.00
The Contract Sum will be increased by this Change Order in the amount of	\$ 0.00
The new Contract Sum including this Change Order will be	\$ 0.00
The Contract Time will be increased by Zero (0) days.	

The new date of Substantial Completion will be

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

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

ARCHITECT (Firm name)	CONTRACTOR (Firm name)	OWNER (Firm name)
SIGNATURE	SIGNATURE	SIGNATURE
PRINTED NAME AND TITLE	PRINTED NAME AND TITLE	PRINTED NAME AND TITLE
DATE	DATE	DATE

DOCUMENT 00 11 16 - INVITATION TO BID

1.1 PROJECT INFORMATION

- A. Notice to Bidders: Qualified bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.
- B. Project Identification: A New Worship Facility for Tabernacle Baptist Church, Architectural Project Number 10238.00.
 - 1. Project Location: 1500 Block of Broad Street, Selma, Alabama 36701.
- C. Owner: Tabernacle Baptist Church, 1431 Broad Street, Selma, Alabama 36701.
 - 1. Owner's Representative: Dr. Otis Dion Culliver.
- D. Architect: Exford Architects, Attn: Fredrick Woods, 3928 Jefferson Avenue, SW, Birmingham, Alabama 35221, (205) 957-6640.
- E. Project Description: Project consists of a replacement "Church" building containing a sanctuary with balcony, classrooms, split HVAC system, toilets, administrative offices, nursing room and ursher's room.
- F. Construction Contract: Bids will be received for the following Work:
 - 1. General Contract (all trades).

1.2 BID SUBMITTAL AND OPENING

- A. Owner will receive sealed bids until the bid time and date at the location indicated below that are prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:
 - 1. Bid Date: **<Insert date**>.
 - 2. Bid Time: 5:00 p.m., local time.
 - 3. Location: Tabernacle Baptist Church Fellowship Hall on basement floor, 1431 Broad Street, Selma, Alabama 36701.
- B. Bids will be thereafter opened in the presence of the bidders and read aloud.

DOCUMENT 00 11 16 - INVITATION TO BID

1.3 BID SECURITY

A. Bid security shall be submitted with each bid in the amount of 5 percent of the bid amount. No bids may be withdrawn for a period of 60 days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

1.4 PREBID CONFERENCE

A. A Prebid conference for all bidders will be held at Tabernacle Baptist Church, 1431 Broad Street, Selma, Alabama 36701 on **<Insert date>** at **[10:00 a.m.] <Insert time>**, local time. Prospective bidders are required to attend.

1.5 DOCUMENTS

A. Online Procurement and Contracting Documents: Obtain access after **<Insert date>** by contacting Architect, or ARC Documents Solutions, LLC, 3104-4th Avenue South, Birmingham, Alabama 35233, (205) 323-1563. Online access will be provided to all registered bidders and suppliers.

1.6 TIME OF COMPLETION

A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time of 365 Calendar Days.

1.7 BIDDER'S QUALIFICATIONS

A. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

END OF DOCUMENT 00 11 16

DOCUMENT 00 22 13 – SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

- A. Instructions to Bidders for Project consist of the following:
 - 1. AIA Document A701, "Instructions to Bidders," a copy of which is bound in this Project Manual.
 - 2. The following Supplementary Instructions to Bidders that modify and add to the requirements of the Instructions to Bidders.

1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

A. The following supplements modify AIA Document A701, "Instructions to Bidders." Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of the Instructions to Bidders shall remain in effect.

1.3 ARTICLE 2 - BIDDER'S REPRESENTATIONS

- A. Add Section 2.1.3.1:
 - 1. 2.1.3.1 The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.
- B. Add Section 2.1.5:
 - 1. 2.1.5 The Bidder is a properly licensed Contractor according to the laws and regulations of The State of Alabama and meets qualifications indicated in the Procurement and Contracting Documents.
- C. Add Section 2.1.6:
 - 1. 2.1.6 The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

1.4 ARTICLE 3 - BIDDING DOCUMENTS

A. 3.2 - Interpretation or Correction of Procurement and Contracting Documents:

DOCUMENT 00 22 13 - SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

- 1. Add Section 3.2.2.1:
 - a. 3.2.2.1 Submit Bidder's Requests for Interpretation using form containing bidders letterhead and submitted to Architect via email.
- B. 3.4 Addenda:
 - 1. Delete Section 3.4.3 and replace with the following:
 - a. 3.4.3 Addenda may be issued at any time prior to the receipt of bids.
 - 2. Add Section 3.4.4.1:
 - a. 3.4.4.1 Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:
 - 1) 3.4.4.1.1 Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.
 - 2) 3.4.4.1.2 Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

1.5 ARTICLE 4 - BIDDING PROCEDURES

- A. 4.1 Preparation of Bids:
 - 1. Add Section 4.1.1.1:
 - a. 4.1.1.1 Printable electronic Bid Forms and related documents are available from Architect.
 - 2. Add Section 4.1.8:
 - a. 4.1.8 The Bid shall include unit prices when called for by the Procurement and Contracting Documents. Owner may elect to consider unit prices in the determination of award. Unit prices will be incorporated into the Contract.
 - 3. Add Section 4.1.9:
 - a. 4.1.9 Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

DOCUMENT 00 22 13 – SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

- 4. Add Section 4.1.10:
 - a. 4.1.10 Bids shall include sales and use taxes.
- B. 4.3 Submission of Bids:
 - 1. Add Section 4.3.1.2:
 - a. 4.3.1.2 Include Bidder's Contractor License Number applicable in Project jurisdiction on the face of the sealed bid envelope.
- C. 4.4 Modification or Withdrawal of Bids:
 - 1. Add the following sections to 4.4.2:
 - a. 4.4.2.1 Such modifications to or withdrawal of a bid may only be made by persons authorized to act on behalf of the Bidder. Authorized persons are those so identified in the Bidder's corporate bylaws, specifically empowered by the Bidder's charter or similar legally binding document acceptable to Owner, or by a power of attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to Owner at the time of seeking modifications or withdrawal of the Bid.
 - b. 4.4.2.2 Owner will consider modifications to a bid written on the sealed bid envelope by authorized persons when such modifications comply with the following: the modification is indicated by a percent or stated amount to be added to or deducted from the Bid; the amount of the Bid itself is not made known by the modification; a signature of the authorized person, along with the time and date of the modification, accompanies the modification. Completion of an unsealed bid form, awaiting final figures from the Bidder, does not require power of attorney due to the evidenced authorization of the Bidder implied by the circumstance of the completion and delivery of the Bid.
- D. 4.5 Break-Out Pricing Bid Supplement:
 - 1. Add Section 4.5:
 - a. 4.5 Provide detailed cost breakdowns no later than two business days following Architect's request.
- E. 4.6 Subcontractors, Suppliers, and Manufacturers List Bid Supplement:
 - 1. Add Section 4.6:
 - a. 4.6 Provide list of major subcontractors, suppliers, and manufacturers furnishing or installing products on forms provided no later than two business days following

DOCUMENT 00 22 13 - SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

Architect's request. Include those subcontractors, suppliers, and manufacturers providing work totaling three percent or more of the Bid amount. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Architect.

1.6 ARTICLE 5 - CONSIDERATION OF BIDS

- A. 5.2 Rejection of Bids:
 - 1. Add Section 5.2.1:
 - a. 5.2.1 Owner reserves the right to reject a bid based on Owner's and Architect's evaluation of qualification information submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed Project staff and proposed subcontractors.

1.7 ARTICLE 6 - POSTBID INFORMATION

- A. 6.1 Contractor's Qualification Statement:
 - 1. Add Section 6.1.1:
 - a. 6.1.1 Submit Contractor's Qualification Statement no later than two business days following Architect's request.
- B. 6.3 Submittals:
 - 1. Add Section 6.3.1.4:
 - a. 6.3.1.4 Submit information requested in Sections 6.3.1.1, 6.3.1.2, and 6.3.1.3 no later than two business days following Architect's request.

1.8 ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

A. 7.1 - Bond Requirements:

DOCUMENT 00 22 13 – SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

- 1. Add Section 7.1.1.1:
 - a. 7.1.1.1 Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.
- B. 7.2 Time of Delivery and Form of Bonds:
 - 1. Delete the first sentence of Section 7.2.1 and insert the following:
 - a. The Bidder shall deliver the required bonds to Owner no later than 10 days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.
 - 2. Delete Section 7.2.3 and insert the following:
 - a. 7.2.3 Bonds shall be executed and be in force on the date of the execution of the Contract.

1.9 ARTICLE 8 - FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

A. AIA A105 - 2017 Standard Form of Agreement Between Owner and Contractor.

1.10 ARTICLE 9 - EXECUTION OF THE CONTRACT

- A. Add Article 9:
 - 1. 9.1.1 Subsequent to the Notice of Intent to Award, and within 10 days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through Architect, in such number of counterparts as Owner may require.
 - 2. 9.1.2 Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.
 - 3. 9.1.3 Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement.
 - 4. 9.1.4 In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or readvertise for bids.

END OF DOCUMENT 00 22 13

DOCUMENT 00 25 13 - PREBID MEETINGS

1.1 PREBID MEETING

- A. Architect will conduct a Prebid meeting as indicated below:
 - 1. Meeting Date: <**Insert date**>.
 - 2. Meeting Time: [2:00 p.m.] <Insert time>, local time.
 - 3. Location: <Insert meeting location and room name>, <Insert street address>, <Insert city, state, and zip code>.
- B. Attendance:
 - 1. Prime Bidders: Attendance at Prebid meeting is mandatory.
 - 2. Subcontractors: Attendance at Prebid meeting is recommended.
 - 3. Notice: Bids will only be accepted from prime bidders represented on Prebid Meeting sign-in sheet.
- C. Bidder Questions: Submit written questions to be addressed at Prebid meeting minimum of two business days prior to meeting.
- D. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:
 - 1. Procurement and Contracting Requirements:
 - a. Advertisement for Bids.
 - b. Instructions to Bidders.
 - c. Bidder Qualifications.
 - d. Bonding.
 - e. Insurance.
 - f. Bid Security.
 - g. Bid Form and Attachments.
 - h. Bid Submittal Requirements.
 - i. Bid Submittal Checklist.
 - j. Notice of Award.
 - 2. Communication during Bidding Period:
 - a. Obtaining documents.
 - b. Access to Project Web site.
 - c. Bidder's Requests for Information.
 - d. Bidder's Substitution Request/Prior Approval Request.
 - e. Addenda.

DOCUMENT 00 25 13 - PREBID MEETINGS

- 3. Contracting Requirements:
 - a. Agreement.
 - b. The General Conditions.
 - c. The Supplementary Conditions.
 - d. Other Owner requirements.
- 4. Construction Documents:
 - a. Scopes of Work.
 - b. Temporary Facilities.
 - c. Use of Site.
 - d. Work Restrictions.
 - e. Alternates, Allowances, and Unit Prices.
 - f. Substitutions following award.
- 5. Separate Contracts:
 - a. Work by Owner.
 - b. Work of Other Contracts.
- 6. Schedule:
 - a. Project Schedule.
 - b. Contract Time.
 - c. Liquidated Damages.
 - d. Other Bidder Questions.
- 7. Site/facility visit or walkthrough.
- 8. Post-Meeting Addendum.
- E. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to attendees and others known by the issuing office to have received a complete set of Procurement and Contracting Documents. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.
 - 1. Sign-in Sheet: Minutes will include list of meeting attendees.
 - 2. List of Planholders: Minutes will include list of planholders.

END OF DOCUMENT 00 25 13

DOCUMENT 00 26 00 – PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

- A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.
- B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.3 PROCUREMENT SUBSTITUTIONS

- A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:
 - 1. Extensive revisions to the Contract Documents are not required.
 - 2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
 - 3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing in compliance with the following requirements:

DOCUMENT 00 26 00 – PROCUREMENT SUBSTITUTION PROCEDURES

- 1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
- 2. Submittal Format: Submit three copies of each written Procurement Substitution Request, using form bound in Project Manual or CSI Substitution Request Form 1.5C.
- 3. Submittal Format: Submit Procurement Substitution Request, using format provided on Project Web site.
 - a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
 - b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
 - 1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
 - 2) Copies of current, independent third-party test data of salient product or system characteristics.
 - 3) Samples where applicable or when requested by Architect.
 - 4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. 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.
 - 5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - 6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
 - 7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.
 - c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
 - d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.
- B. Architect's Action:
 - 1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

A NEW WORSHIP FACILITY FOR TABERNACLE BAPTIST CHURCH SELMA, ALABAMA PROJECT NUMBER 10238.00/5.1 Page 3 of 3

DOCUMENT 00 26 00 – PROCUREMENT SUBSTITUTION PROCEDURES

C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 00 26 00

DOCUMENT 00 31 13 - PRELIMINARY SCHEDULES

1.1 PROJECT SCHEDULE

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but do not affect Contract Time requirements. This Document and its attachments are not part of the Contract Documents.
- B. Available Project information includes the following:
 - 1. Project Schedule.
- C. Project schedule including design and construction milestones and Owner's occupancy requirements is available for viewing on Project website.
- D. Related Requirements:
 - 1. Document 004113 "Bid Form Stipulated Sum (Single-Prime Contract)" for Contract Time.
 - 2. Section 011000 "Summary" for phased construction requirements.
 - 3. Section 013200 "Construction Progress Documentation" for Contractor's construction schedule requirements.

END OF DOCUMENT 00 31 13

DOCUMENT 00 31 19 – EXISTING CONDITION INFORMATION

1.1 EXISTING CONDITION INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. Survey information that includes information on existing conditions, prepared by Montgomery and Hinkle, Inc., dated 13 September 2021, is available for viewing as part of Drawings.
- C. Related Requirements:
 - 1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
 - 2. Document 003132 "Geotechnical Data" for reports and soil-boring data from geotechnical investigations that are made available to bidders.

END OF DOCUMENT 00 31 19

DOCUMENT 00 31 32 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.
- B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.
- C. A geotechnical investigation report for Project, prepared by Carmichael Engineering Inc., dated 31 January 2022, is available for viewing as appended to this Document.
 - 1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
 - 2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.
- D. Related Requirements:
 - 1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
 - 2. Document 003119 "Existing Condition Information" for information about existing conditions that is made available to bidders.

END OF DOCUMENT 00 31 32

Report of Geotechnical Subsurface Investigation

Tabernacle Baptist Church Family Life Center

Broad Street Selma, Alabama Our Job No. G22-6371



Montgomery, AL 36124-1702

Phone: 334-213-5647 Fax: 334-213-7348 Report of Geotechnical Subsurface Investigation

Tabernacle Baptist Church Family Life Center

Broad Street Selma, Alabama Our Job No. G22-6371

Prepared For:

Dr. Otis D. Culliver Tabernacle Baptist Church 1431 Broad Street Selma, Alabama 36701

Prepared By Carmichael Engineering, Inc. P. O. Box 241702 Montgomery, Alabama 36124-1702

334-213-5647 www.carmichaelengineering.com

January 31, 2022



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Aerial Bore Plan Site Boring Plan Test Boring Logs Laboratory Test Data Investigative Procedures Notes and References Unified Soil Classification Chart Exhibit C



1.0 Introduction

Carmichael Engineering, Inc., is pleased to provide this report of our subsurface investigation for the planned Tabernacle Baptist Church Family Life Center. The scope of this investigation included 7 soil test bores in the proposed building and pavement areas. The quantity and location of the test bores were taken in accordance with the authorized scope of work. The intent of this investigation was to evaluate the subsurface conditions with respect to the development of the site for support of the proposed building and pavements.

This report has been prepared in accordance with generally accepted current standards of geotechnical engineering practices and no other warranties are expressed or implied. The recommendations of this report are based on our professional judgment considering the proposed construction as described by this report and the data available to us. The construction should include follow up geotechnical monitoring and construction materials testing by our firm. It is important that we confirm the expected subsurface conditions based on the soil boring data during the construction phase. This report is presented on the basis that all of our recommendations will be followed.



2.0 Summary

Generally, the subsurface investigation indicated conditions which should be compatible with the proposed development provided the site preparation and construction are completed in accordance with the recommendations which follow in this report. Please note that our recommendations are site specific and may not be suitable for other types of structures or other locations.

A total of 7 test bores were completed to evaluate the subsurface profile. Beneath a 1 to 5" thickness of organic topsoil, a 2" thickness of asphalt pavement and a 1" thickness of crushed stone, the test bores penetrated possible fill earth and in-situ soil. The possible fill earth and in-situ earth was described as cohesive clayey sand (sections with gravel), sandy clay, plastic clay, and non-cohesive silty sand (sections with gravel) and coarse sand with gravel. Some of the upper sections of earth may have been fill earth from previous developments, however, the suspect fill earth was similar in nature to the in-situ soil and we were unable to distinguish fill earth from the in-situ earth in the test bores. Soil samples at depths of 8.5 to 10' below ground surface in two of the test bores indicated a petroleum odor. The predominate sand earth is of a marginal to good drainage classification. The predominate clay earth is of a poor drainage classification. The native plastic clay is expansive. However, the expansive plastic clay was present at depths of 8.5' or more below ground surface and will not impact the performance of building or pavement structures at the site. The test bores indicated soil strengths of low to moderate and consolidation characteristics which are expected to be compatible with the planned type of construction.

Twenty-four hours following drilling, all of the test bores indicated groundwater at depths of 4.4 to 6.2'below ground surface. The test bores caved at depths of 6.0 to 11.6' below existing ground surface. The groundwater condition at this site is subject to seasonal variation and is expected to fluctuate. We do not anticipate that the groundwater condition will affect the long-term performance of this project. Shallow groundwater (if any) encountered during construction can be controlled using shallow drainage ditches, sump pumps and/or permanent underdrains.

The primary concern for the development of the site is the shallow groundwater levels and the low soil strengths in the upper sections of earth. Sections of the site have been previously developed and localized areas of the upper soil sections may have been disturbed from previous construction and demolition activities. The upper soil sections should be improved by compacting the exposed subgrade. Grading information for the site was not provided. Considering the shallow groundwater conditions and low soil strengths we recommend that finish floor elevations be set at elevation 129.5 or higher. The foundations should be designed using low net allowable soil bearing pressures to reduce the requirements for site preparation.

Following proper site preparation, the project can use conventional design and construction techniques to develop a shallow spread foundation system for support of the proposed building structure. The exposed subgrade in all foundation trenches should be compacted to 98% standard density with mechanical "jumping jack" type compactors. Areas which fail to compact should be undercut to expose a firm level of soil prior to the placement of the foundation concrete. The building spread foundations can be designed to bear transitional between the firm in-situ earth (compacted as



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required) and/or new "engineered fill" earth utilizing net allowable soil bearing pressures of up to 1,500 pounds per square foot for isolated square foundations and 1,250 pounds per square foot for continuous foundations.

The pavement development for this project can advance using locally available materials and conventional construction techniques. The pavement sections may be developed using a crushed aggregate base and high stability bituminous pavement, or a concrete pavement section placed directly over an improved layer of the subgrade earth.



3.0 Evaluation

3.1 Site Location

The site subject to this report is located on the west of Broad Street between Philpot Avenue and Minter Avenue in the City of Selma, Dallas County, Alabama. Our field personnel utilized the provided instructions and site plan to locate the site and test bore locations using a survey grade GPS. Ground elevations at each bore location were determined with the GPS. The accuracy of the GPS can be influenced by adjacent structures, tree canopies and weather conditions. The GPS data has not been field verified and the bore locations and ground elevations should be considered approximate. The enclosed boring plans further describes the test boring locations.

3.2 Site Conditions

The site consisted of an irregular shaped parcel of property. There were 2 single story building structures and some concrete pavements present on the site. Other areas included grass vegetation. The planned new building site was described as clear and open. Several former building structures had been demolished and removed from the site in the area of the planned new building.

The local terrain was described as gently sloping. Surface drainage was described as good. Surface water is expected to flow over the site and discharge beyond the area planned for development. There was no ponded water present on the site during the field testing.

Site access was described as good. There was no unusual difficulty mobilizing our ATV mounted drilling rig to complete the test bores.













3.3 Site Geology and Subsurface Stratigraphy

Geologically, the site is mapped in the Coastal Plain Provence, and is underlain by the Mooreville Chalk Formation, deposited in the Upper Cretaceous Epoch of the Cretaceous Period. Typically, the Mooreville Chalk formation yields finely sandy argillaceous fossiliferous chalk, the upper sections of which have weathered into a cohesive expansive clay soil. The area south of the site is located in an area underlain by alluvial and low terrace deposits placed in the Holocene Epoch of the Quaternary Period. Typically, this formation yields fine to coarse quartz sand with clay lenses and gravel in places. The test bores penetrated soils predominantly associated with the alluvial deposits.

The test bores penetrated 1 to 5" of organic topsoil. Bore B-6 continued beneath the topsoil into 2" of asphalt pavement and 1" of crushed stone. Beneath the topsoil and asphalt pavement and 1" of crushed stone the test bores penetrated suspect fill earth and in-situ earth described as cohesive clayey sand (sections with gravel), sandy clay, plastic clay, and non-cohesive silty sand (sections with gravel) and coarse sand with gravel. Some of the upper sections of earth may have been fill earth from previous developments, however, the suspect fill earth was similar in nature to the in-situ soil and we were unable to distinguish fill earth from the in-situ earth in the test bores. Bore B- 3 and B-5 indicated a petroleum odor in the samples from 8.5 to 10' below ground surface. Laboratory analyses confirmed "SM", "SC", and "CL" Unified Soil Classifications of the predominate silty



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sand, clayey sand and sandy clay with plasticity indices of non-plastic, 11, 14, and 19. The penetration resistance values, "N", ranged from 5 to 26 blows per foot indicating relative densities of loose to very firm in the predominate sand earth and consistencies of firm to very stiff in the predominate clay earth. Moisture tests indicated water contents ranging from 11.5 to 43.5%. The test bores were terminated in the in-situ earth at depths of 10 to 25' below existing ground surface.

Twenty-four hours following drilling, all of the test bores indicated groundwater at depths of 4.4 to 6.2' below ground surface. The test bores caved at depths of 6 to 11.6' below existing ground surface.

The enclosed test boring records further describe the subsurface stratigraphy, Unified Soil Classifications, penetration resistance values, moisture contents, water levels, caved depths, auger refusal depth, and boring termination depths.

3.4 General Construction Information

The following data was extrapolated from the provided construction information and plans. The construction data described in this section was considered in the formulation of our recommendations; therefore, any significant changes, additions, or modifications to the planned development may have a significant impact on our recommendations. We ask that we be advised of any significant errors, omissions, or revisions in the construction data to permit further comment as needed.

We understand the proposed development will include church type building construction along with related grading, drainage, and pavement improvements. The proposed building structure will include single to two story height, shallow spread foundations, concrete floor slab on grade, and wood or steel frame with brick veneer type construction. Specific structural loading information was not provided to us. Wall loads are expected to be in the range of 2 to 3 kips per linear foot and concentrated loads are expected to be in the range of 45 to 90 kips. We do not expect that the planned construction will be particularly sensitive to usual settlements.

Specific pavement design criteria were not provided to us. The pavements are expected to be subjected to a light to medium duty traffic classification with a moderate volume of automobiles and occasional church buses and occasional medium to heavy weight service trucks.

Specific grading information was not provided to us. Based on the existing grades, we anticipate earth filling thicknesses of less than 3' will be required to establish subgrade elevation in the building and pavement areas. Fill earth required to establish subgrade elevation is expected to originate from on-site cuts and/or local off-site borrow sources.

One of the enclosed boring plans further describes the planned development.


4.0 Recommendations - Site Preparation

4.1 "Controlled Areas"

Define those areas throughout and 5' beyond the proposed building area, beneath and 5' beyond the pavement areas, and throughout significant slopes as "controlled areas".

4.2 Stripping

Remove all vegetation, topsoil, stumps, old pavements, old foundations, abandoned utilities and drains, and otherwise unsuitable materials from the "controlled areas". All unsuitable materials should be wasted beyond the "controlled areas". Caution should be used in the removal of old foundations, utilities, and drains, etc. (if any), to minimize disturbance of the underlying subgrade soils.

4.3 Surface Drainage

Maintain the "controlled areas" in a drained condition that will ensure the continual removal of surface water that may flow over the construction areas. Temporary site drainage can be enhanced by the installation of the final drainage structures during the early phases of the site development.

4.4 Site Examination

Prior to the placement of fill earth and following removal of cut earth, the "controlled areas" should be examined by Carmichael Engineering, Inc. This examination should include proof rolling with construction equipment, test pits, supplemental test bores, visual examinations, etc., as needed to determine the presence, location, and extent of any latent weak soil, and/or otherwise unsuitable soil conditions which may exist at the site. Areas which exhibit weak soil or otherwise unsuitable conditions should be corrected in accordance with our recommendations. Typically, areas which yield excessively under proof rolling should be undercut to expose a firm level of soil followed by back-filling with "engineered fill".

4.5 Subgrade Improvements

Sections of the site have been previously developed and localized areas of the upper soil sections may have been disturbed from previous construction and demolition activities. Following stripping and prior to the placement of any fill earth, the exposed subgrade in the building and pavement "controlled areas" should be processed and compacted to 98% of the materials ASTM D-698 standard density using a heavy vibratory compacter. At the time of densification, the moisture content of the existing subgrade should be within \pm 3% of the materials optimum water content. Following completion of the compaction effort, the "controlled areas" should be proof rolled. Areas which fail to compact or areas which yield excessively under a proof roll should be undercut to expose a firm earth followed by backfilling with "engineered fill". Considering the shallow groundwater conditions at the site, we recommend that the finish floor elevation be set at 129.5 or higher.

4.6 Proof Rolling

Proof rolling should be completed using rubber-tired construction equipment or a partially loaded dump truck weighing 40 tons. Proof-rolling should include a minimum of 2 passes in perpendicular directions over the "controlled areas". Areas which yield excessively should be



corrected in accordance with our recommendations. Do not proof roll when the subgrade soil is saturated.

4.7 Fill Earth

Fill earth required to establish subgrade elevation in the "controlled areas" can consist of the clean, non-saturated, and non-organic sections of the native earth typical of that penetrated by the test bores. The use of the native soils for structural fill should be limited to those materials with plasticity indices of 25 or less. Suitable sections of the cut earth may be stockpiled for reuse as "engineered fill". Processing and moisture conditioning will be required to properly compact the on-site soils.

4.8 "Select Fill"

Fill earth placed in "controlled areas" and originating from an off-site borrow source (if any) should be designated as "select fill". The "select fill" should consist of a clean, non-saturated, and non-organic clayey sand or silty clayey sand that meets the following criteria.

	1
Sieve Requirements	% Passing
3"	100
No. 4	75 - 100
No. 200	20 - 40
Liquid Limit	35 max
Plasticity Index	4 to 10
Maximum Dry Unit Weight Based on ASTM-698 Standard Density Test	\geq 105 pcf

"Select Fill" Composition

Note: Coarse sand fill may be used in lieu of "select fill" when placed at least 12" above the outside finish grade and the sand material is confined by the foundation walls.

4.9 "Engineered Fill"

Unless otherwise specified, all fill earth placed in the "controlled areas" should be designated as "engineered fill". Place fill earth in thin lifts not to exceed 8" loose measure and thoroughly compact each lift of fill to at least 98% of the materials ASTM D-698 standard density. At the time of densification, the moisture content of the "engineered fill" should be within 3% of the materials optimum water content. Following acceptance for moisture and density, any "engineered fill" areas which are disturbed should be corrected and retested prior to the

placement of additional fill earth or structures.



4.10 Seasonal Weather Considerations

The native soils contain an appreciable amount of clay and silt fines. During the normally wetter winter and spring seasons, the upper sections of soil can become wet or saturated and the soil will pump and yield under heavy construction traffic. Excessive moisture contents in the on-site soils may require that the on-site soils be replaced with an off-site borrowed "select fill" material if the materials cannot be reasonably processed and dried for compaction in a timely manner. The site preparation, to the extent possible, should be completed during the normally drier summer and fall seasons. Expect site preparation delays and an increase in the volume of soil requiring remediation during the wetter winter and spring seasons.



5.0 Recommendations - Shallow Foundations and Ground Supported Floor Slabs

5.1 Maximum Net Allowable Soil Bearing Pressures

1,500 pounds per square foot for isolated square foundations. 1,250 pounds per square foot for continuous foundations.

Note: Foundations may bear transitional between the firm to stronger in-situ and/or new "engineered fill" earth exhibiting "N" values of 7 or greater.

5.2 Minimum Load Bearing Foundation Dimensions

Width: Isolated square foundations - 30"

Continuous wall foundations - 18" Turned down slab edges - 12"

Depth: Bottom of perimeter foundations below outside finish grades - 18". Bottom of interior foundations below the top of concrete floor slabs - 18".

Note: All foundations should be sized for total load but should not be less than the minimum dimensions shown above.

5.3 Settlement

The planned building structure will be subjected to total long term settlements of less than 1", with differential settlements of less than 1/2". The building foundations should be designed to tolerate these estimated settlements.

5.4 Seismic Design Parameters

The seismic design parameters from the IBC 2018 are as follows for the subject site in Selma, Alabama.

 $\begin{array}{lll} S_S = 0.167 & S_{MS} = 0.268 & S_{DS} = 0.179 \\ S_1 = 0.078 & S_{M1} = 0.188 & S_{D1} = 0.125 \\ \text{Site Class D} \end{array}$

Seismic Design Category B for Use Group I, II or III and Seismic Design Category C for Use Group IV.

5.5 Foundation Construction

Do not permit foundation bearing soil to become saturated or dry excessively. Caution should be used not to disturb the foundation bearing level of soil. The exposed subgrade in all foundation trenches should be compacted to 98% standard density with mechanical "jumping jack" type compactors. Areas which fail to compact should be undercut to expose a firm level of soil prior to the



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placement of the foundation concrete. Any weak soil should be replaced with non-reinforced lean concrete ("mud sill"). All loose soil material or other debris should be removed from the top of the "mud sill" before placing the reinforced foundation concrete.

For budget purposes, assume 50 cubic yards of over excavation and replacement with "mud sill" concrete will be required to remove and replace weak soils exposed in the foundation trenches. Provide a add/deduct cubic yard unit price for more or less undercutting and replacement with "mud sill" concrete.

Following construction of the foundations, the area adjacent to the foundation should be maintained in a drained condition. Water should not be permitted to pond adjacent to the building foundations during or following construction. Backfill adjacent to the building foundations as soon as possible to provide positive drainage. Backfill with clean soil typical of the material excavated from the foundation trenches. Masonry sand, broken brick and block or other construction debris should not be used to backfill against the foundations.

5.6 Floor Slab Bearing Conditions

Floor slabs should bear over the firm to stronger in-situ earth and/or new "engineered fill" earth. Provide a minimum 6" layer of suitable compactable granular fill ("select fill", crushed stone base, no. 8910 crushed stone, etc.) compacted to at least 98% of the materials ASTM D-698 standard density. Provide a minimum 15 mil vapor barrier between the subgrade earth and the floor slabs. All vapor barrier joints should be overlapped and taped. Care should be taken not to damage the vapor barrier during placement of the floor slab concrete.

5.7 Acceptance of Foundations and Floor Slab Bearing Levels

All foundation excavations and floor slab bearing levels should be examined by a qualified geotechnical consultant prior to the installation of the reinforcement and concrete for the foundations and vapor barrier for the floor slabs. All unacceptable conditions should be corrected in accordance with the geotechnical consultant's recommendations.

5.8 Control/Expansion Joints

A liberal amount of control/expansion joints should be used in the concrete floor slabs, masonry walls and brick veneer walls to reduce the effects of the normal amounts of differential settlement and concrete shrinkage expected. The design and location of the control and construction joints should be in accordance with the recommendations of the Portland Cement Association.



6.0 Recommendations – Foundation Walls

6.1 Lateral Earth Pressures

Table 1 provides lateral earth pressures for foundation walls which are restrained from rotation.

Table 1						
Material	Wet Unit Weight (pcf)	"At Rest" Earth Pressure Coefficient (Ko)	Lateral Earth Pressure (psf per foot of depth)*			
Off-Site Free Draining Clean Coarse Sand	110	0.46	50.6			
Graded No. 57 or No. 67 Stone	105	0.43	45.2			
Native Earth	135	0.58	78.3			

* Note: These pressures do not include lateral pressures introduced from adjacent foundations, floor slabs, equipment or other extraneous sources. In order to utilize the lateral earth pressure for sand fill or stone fill, the fill should be sloped from the foundation level behind the wall at 1(H):1(V) or flatter.

6.2 Backfill

Develop as "engineered fill", 98% of the materials ASTM D-698 standard density. Place fill using hand directed compaction equipment. Do not use heavy construction equipment adjacent to the foundation walls unless the walls are adequately braced to withstand the lateral pressures imposed by such loadings.

6.3 Wall Drainage

Place minimum 1" diameter weep holes at minimum spacings of 6' on center along the face of the wall near the base. Use filter fabric to prevent clogging of the weep holes. Fill material placed against the weep holes should consist of a free draining sand or graded stone.



7.0 Recommendations - Pavement Development

7.1 Reference

Alabama Department of Transportation (ALDOT), <u>Standard Specifications For Highway</u> <u>Construction</u> 2018 Edition.

7.2 Subgrade Support Values

Based on an estimated California Bearing Ratio (CBR) for the native earth expected to be predominate at subgrade elevation, a design CBR value of 6 is recommended.

7.3 Traffic Data

Specific design pavement traffic data was not available. The pavements are expected to be subjected to a light to medium duty traffic classification including a moderate volume of automobiles and occasional church buses and occasional medium to heavy weight service trucks.

7.4 Subgrade Improvements

Thoroughly mix and compact the top 6" of subgrade to 100% standard density.

Slope subgrade to provide positive drainage to side drainage ditches, underdrains, and/or storm drains to prevent the entrapment of water in the subgrade layer.

7.5 Light to Medium Duty Pavement Sections

Based on a CBR value of 6 and a 20-year design life, the light to medium duty pavement sections may be developed using a crushed aggregate base and high stability bituminous pavement, or a concrete pavement section placed over the improved subgrade layer as follows:

7.5.1 Crushed Aggregate Base and High Stability Bituminous Pavement Section

- 1.5" ALDOT Section 424-A 340 bituminous wearing surface.
- 1 ALDOT Section 405 bituminous tack coat.
- 1.5" ALDOT Section 424-B 634 bituminous binder.
- 1 ALDOT Section 401-A bituminous prime coat.
- 6" ALDOT Section 825 crushed aggregate base (100% modified density).
- 6" ALDOT Section 230 improved roadbed (100% standard density).
- Note: All bituminous pavements should be designed on the fine side of the restricted zone to reduce the permeability of the asphalt pavement.

7.5.2 Concrete Pavement Section

- 6" 4,000 psi compressive strength (550 psi flexural strength) concrete, maximum 4" slump.
- 6" ALDOT Section 230 improved roadbed (100% standard density).

7.6 Concrete Pavement Joints

The design and location of construction and control joints should be in accordance with the recommendations of the Portland Cement Association. We recommend a maximum control joint spacing of 12'. All joints should be filled with a suitable flexible joint compound to prevent water intrusion at the joints.



7.8 Material Thicknesses

All material thicknesses referred to in this section are completed thicknesses.



<u>8.0 General Recommendations</u>

8.1 Utility Trenches

All utility trenches (new and existing) extending through the "controlled areas" should be backfilled with "engineered fill".

8.2 Grading and Drainage Improvements

Incorporate finish grades, pavements abutting the building construction, side drainage ditches, underdrains, roof drains which discharge into storm drains, etc., to reduce the possibility of ponding surface water within 5' of the edges of the building and pavements.

8.3 Vertical Cuts

Vertical cuts greater than 4' or cuts required to remain open for extended periods of time should be sloped or braced as required for the protection of workmen entering deep excavations. Heavy construction traffic and stockpiling of excavated earth or other materials should not be permitted near the top of open unsupported excavations. Current OSHA regulations should be adhered to with respect to excavations for this project.

8.4 Cut and Fill Slopes

Cut and fill slopes should perform satisfactorily as steep as 2.5(H):1(V) in the earth typical of that penetrated in the upper strata at the site. All slopes should be protected from erosion using suitable vegetation or pavements.

8.5 Quality Control

Carmichael Engineering, Inc., should provide the following minimum services during the construction phase:

- 8.5.1 Verify the results of the correction of weak soil conditions, the quality and density of "engineered fill", and the conditions of the foundation trenches, floor slab and pavement subgrade bearing levels.
- 8.5.2 Complete soil particle size, atterberg limit, and laboratory compaction tests on each different type of fill earth used in the "controlled areas".
- 8.5.3 Complete a minimum of 5 field density test in the building areas per each foot of vertical thickness of fill. Also, a minimum of 1 field density test should be taken for each 50 linear feet per each 2' of vertical thickness of fill placed at utility trenches extending through "controlled areas". One field density test should be taken on each 3000 square feet per each foot of fill placed in the pavement areas.
- 8.5.4 Test all structural concrete in accordance with the guidelines established by the American Concrete Institute.
- 8.5.5 Quality assurance testing on the improved subgrade, base and pavement materials should be in accordance with the Alabama Department of Transportation Specifications.



9.0 General Comments

The scope of this study did not include sampling or testing for an environmental analysis or assessment for this site. If an environmental assessment of this site is desired, we should be contacted for further comment.

The comments of this report do not consider local flood conditions. The local flood condition/elevation (if any) should be determined and considered in the design of this project.

The frost penetration depth in the area of this project is generally taken to be less than 10". Provided our recommendations for the development of foundations, floor slabs, and pavements are followed, we do not expect that the frost penetration will have any detrimental effects on the performance of these structures.

The comments of this report are based upon our interpretation of the construction information supplied by others, the data collected at the 7 test bores, and our visual examination of the site. The evaluation of subsurface conditions based on the 7 test bores taken with this study requires a significant amount of interpolation. Improper site preparation, extremes in climatic conditions, significant changes in location, grades, time, etc., can each affect groundwater, surface, and subsurface conditions. If conditions are encountered as the construction advances which vary significantly from those described by this report, we should be contacted for supplemental comment.

The scope of this investigation is not intended to establish volumetric estimates of the various subsurface materials at the site. Volumetric estimates may require a larger number of test bores placed on a close grid to establish reliable cross sections. If volume estimates are required of us for the design/development of this project to advance, please contact us for further comment.

Following your request, we are available to provide a review of the final plans and project specifications with respect to their compatibility with the contents of this report. Furthermore, our firm would appreciate the opportunity to continue to serve as the geotechnical consultant and to provide the construction materials testing and monitoring for this project.



10.0 Signature

Thank you for selecting Carmichael Engineering, Inc., to provide the geotechnical services for this project. We are available to answer any questions concerning our findings and recommendations. If we can be of any further assistance, please contact our office.

Sincerely,

PROFESS J. Stephen Carmichael, P.E. Licensed Al #15730 1 – Dr. Otis D. Culliver (email) **Report Distribution:** 1 – Mr. Carl Exford – Architect (email) 1 – Mr. Fredrick Woods – Architect (email)

JSC/as







MINTER AVENUE

EXISTING TABERNACLE BAPTIST CHURCH

















INVESTIGATIVE FIELD PROCEDURES

<u>Penetration Testing & Split Barrel Sampling:</u> A standard 2.0" O.D. (1.4" I.D.) split barrel sampler is first seated 6" to penetrate any loose cuttings and then driven an additional 12" with blows of a 140-pound hammer falling 30". The number of blows required to drive the sampler the final foot is recorded and designated the "penetration resistance" (N). (ASTM D- 1586)

<u>Soil Boring (SB)</u>: The test bore is advanced by a drilling rig utilizing 5-5/8" O.D. (2-1/4" I.D.) hollow stem augers. Soil samples are obtained with a standard split-tube sampler by driving the sampler thru the hollow auger. Collected soil specimens are sealed in air tight containers and delivered to the laboratory to confirm the drillers classifications. (ASTM D- 1452 & 1586)

<u>Auger Boring (AB)</u>: Steel flight augers are utilized to advance the test bore. The soils are visually classified and sampled from the cuttings which are bought to the surface. (ASTM D-1452)

<u>Undisturbed Sampling (UD):</u> Relatively undisturbed soil samples are obtained by forcing a section of 3" O.D. 16-gauge steel tubing into the soil at the desired sample location. The tube is then sealed from moisture loss and delivered to the laboratory for possible laboratory testing.

<u>Rotary-Wash Boring (RB)</u>: The drilling operation is performed by first setting a length of casing and then advancing the test bore by "jetting" a bentonite solution thru drill rods and bit.

<u>Core Drilling (CD):</u> The test bore is advanced thru rock by coring which utilizes a diamond bit and a double tube, swivel type core barrel. (ASTM D-2113)

<u>Monitoring Wells (MW):</u> Temporary or permanent wells may be installed to provide the accurate water table determination and periodic monitoring. The well is constructed with 1.5" to 4" diameter PVC pipe meeting current standards for monitoring well construction.



NOTES AND REFERENCES

Soil descriptions are based on the predominate constituent of the material and are further described by appropriate modifiers in reverse order of their importance. For example, a predominate sand soil containing clay would be described as "clayey sand". Additional modifiers may be used, beginning with the least important constituent such as "silty clayey sand", etc.

Water levels shown on the test boring logs reflect those levels measured at the specified time and date indicated on the logs. These water levels are subject to seasonal fluctuation and can be effected by local surface drainage and/or rainfall during the monitoring period.

The following table describes soil relative densities and consistencies based on penetration resistance values (N) determined by the Standard Penetration Test. The "N" values are estimated for hand tool bores using a portable dynamic cone penetrometer.

	Ν	Relative Density
	0 – 3	Very Loose
	4 - 9	Loose
Sand	10 – 19	Firm
	20 - 29	Very Firm
	30 - 49	Dense
	50+	Very Dense
	Ν	Consistency
	0 - 2	Very Soft
	3 - 5	Soft
	6 - 11	Firm
Clay and Silt	12 - 17	Stiff
	18 - 29	Very Stiff
	30 - 49	Hard
	50+	Very Hard

Laboratory Test References

Test	Reference
Moisture Content	ASTM D-854
Particle Size Analysis	ASTM D-421,422,1140
Atterberg Limit	ASTM D-423, 424
Specific Gravity	ASTM D-2216
Compaction Test	ASTM D-698, 1557
California Bearing Ratio Test	AASHTO T-193
Triaxial Shear Test	ASTM D-2850
Unconfined Compression Test	ASTM D-2166
Consolidation Test	ASTM D-2435
Soil Permeability Test	ASTM D-2434



The Unified Soil Classification System

Major divisions		Group symbol		Typical names	Classification criteria for coarse-grained soils					
	f coarse	than No. 4 sieve :e)		gravels no fines)	GW		Well-graded gravels, gravel- sand mixtures, little or no fines	C, 1 ≤	J≥ 4 C _C ≤ 3	
arse-grained soils :erial is larger than No. 200)	an half of		ze)	Clean (little or	GP		Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradati (C _U < 4 or 1> C _C > 3)	on requirements for GW	
	s (more th	n is larger	si	with fines ole amount ines)	GM	d/u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below A line or I _P < 4	Above A line with 4 < I _P < 7 are borderline cases requiring use of dual	
	Gravel	fractio		Gravels v (appreciat of fi	GC		Clayey gravels, gravel-sand- clay mixtures	Atterberg limits below A line with I _P > 7	symbols	
Cc of ma	arse	sieve		sands or no es)	SW		Well-graded sands, gravelly sands, little or no fines	CU ≥ 6 1 ≤ C _C ≤ 3		
an half	alf of co	an No. 4		Clean (little fin	SP		Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for S ($C_{11} < 6$ or $1 > C_c > 3$)		
(more tha	ore than h	fraction is smaller tha size)	size)	size)	ith fines le amount nes)	SM	d/u	Silty sands, sand-silt mixtures	Atterberg limits below A line or I _P < 4	Limits plotting in hatched zone with 4 ≤ I _P ≤ 7 are borderline
	Sands (m			Sands wi (appreciabl of fir	SC		Clayey sands, sand-clay mixtures	Atterberg limits above A line with I _P > 7	cases requiring use of dual symbols	
an No. 200)	Silts and clays (liguid limit < 50)		رن (0)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	 Determine percentages grain-size curve. Depending on percenta smalled than 200 sieve size 	s of sand and gravel from ages of fines (fraction ze), coarse-grained soils are	
			(liquid limit < 5	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	classified as follows: Less than 5%-GW, GP, SW More than 12%-GM, GC, 5 5 to 12%-Borderline case	/, SP SM, SC s requiring dual symbols.		
ed soils is smaller t	d soils s smaller tl		OL		Organic silts and organic silty clays of low plasticity					
Fine-graine (more than half of material i		ts and clays aid limit > 50)			МН		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
					СН		Inorganic clays or high plasticity, fat clays	$C_U = C_C = D^2$	D ₆₀ /D ₁₀ ₃₀ /D ₁₀ D ₆₀	
			Si	(liq.	ОН		Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt		Peat and other highly organic soils		C			





EXHIBIT C

CARMICHAEL ENGINEERING, INC. GENERAL CONDITIONS OF AGREEMENT WITH THE CLIENT

1. PAYMENT TERMS. CARMICHAEL ENGINEERING, INC., (hereinafter called "CEI") will submit invoices to client monthly and a final bill upon completion of services. Invoice will show charges for different personnel, unit prices and/or expense classifications unless a lump sum payment is agreed to as part of this agreement. Payment is due upon presentation of invoice and is past due ten (10) days from the invoice date. Client agrees to pay a finance charge of one and one-half percent (1 1/2%) per month (minimum of \$15.00 per month) on the principal amount of any past due account. In the event CEI deems it necessary to refer the account to an attorney for collection, client agrees to pay all costs of collection, including a reasonable attorney's fee.

2. INSURANCE. CEI maintains Worker's Compensation and Employer's Liability Insurance in conformance with applicable state law. In addition, we maintain Comprehensive General Liability Insurance and Automobile Liability Insurance with bodily injury limits and property damage limits of, to wit \$1,000,000 combined single limit. A certificate of insurance can be supplied evidencing such coverage which contains a clause providing that fifteen (15) days written notice be given prior to cancellation. Cost of the above is included in our quoted fees. If additional coverage, such as additional insured endorsements, waiver of subrogation or increased limits of liability are required, CEI will endeavor to obtain the requested insurance and charge separately for costs associated with additional coverage or increased limits.

3. STANDARD OF CARE. The only warranty or guarantee made by CEI in connection with the services performed hereunder is that we will use that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended by our proposal for geotechnical/environmental services or by our furnishing oral or written reports.

4. LIMITATION OF LIABILITY. Client agrees to limit CEI's liability to client, and to all construction contractors and subcontractors on the project, arising from CEI's professional acts, errors or omissions or other professional negligence, so that the total aggregate liability of CEI to all those named shall not exceed \$200,000.

5. RIGHT OF ENTRY. Unless otherwise agreed in writing, client will provide for the right of entry for CEI, its agents and employees and all equipment necessary for the completion of the work. While CEI will take reasonable precautions to minimize any damage to the site, it is understood by the client that in the normal course of work some damage may occur and that the cost of correction or repairing such damage is not included in the quoted fee and CEI is not responsible unless specifically stated. If client desires CEI to repair or correct the damage, the cost of such repairs or corrections will be paid by client as an additional fee.

6. EXISTING MAN MADE OBJECTS. It is the duty of the client to disclose the presence and accurate location of all hidden or obscure man made objects, including utility lines, relative to field test or boring locations. CEI field personnel are trained to recognize clearly identifiable stakes or markings in the field and, without special written instructions to initiate field testing, drilling and/or sampling within a reasonable distance of each designated location. If CEI is notified in writing of the presence or potential presence of underground or above ground obstructions, such as utilities, CEI will give special instructions to its field personnel. Client agrees to indemnify and save harmless CEI from all claims, suits, losses, personal injuries, deaths and property liability resulting from unusual subsurface structures, owned by client or third parties, occurring in the performance of the proposed services, the presence and exact locations of which were not revealed to CEI in writing, and to reimburse CEI for expenses in connection with any such claims or suits, including reasonable attorney's fees.

7. SAMPLING OR TESTING LOCATION. The fees included in the Agreement do not include costs associated with surveying of the site or the accurate horizontal and vertical locations of tests. Field test or boring locations described in CEI's report or shown on sketches are based on specific information furnished by the client or clients agent or estimates made by CEI technicians. Such dimensions, depths or elevations should be considered as approximations unless otherwise stated in the report or contracted for at the inception of the Agreement.

8. SAMPLE DISPOSAL AGREEMENT. CEI will retain soil and rock samples which are not used for testing for forty-five (45) days after submission of our report. After forty-five (45) days the retained samples will be discarded unless the client has made written request for storage or transfer of the samples. Client shall be responsible for the expense of such storage or transfer.

9. SAFETY. When CEI provides periodic observations or monitoring services at the job site during construction, Client agrees that, in accordance with generally accepted construction practices, the contractor (i.e. not CEI) will be solely and completely responsible for working conditions on the job site, including safety of all persons and property during the performance of the work, and compliance with OSHA regulations, and that these requirements will apply continuously and not be limited to normal working hours. Any monitoring of the contractor's procedures conducted by CEI is not intended to include review of the adequacy of the contractor's safety measures in, on, adjacent to, or near the construction site.

10. ENGINEERING, EQUIPMENT AND TECHNICAL SERVICES. Fees for such services are based on all time spent on the project by engineering or technical personnel at the hourly or unit rates of the Fee Schedules. The quoted fee may not cover the cost of conferences, site visits, review of foundation plans and specifications, or other services subsequent to submission of our report. Such additional services will be invoiced at the applicable rates. All engineering and technical work is generally done by CEI's regular employees; however, special services by other firms or consultants may be needed on occasion and will be invoiced at the applicable rates but no "outside" services will be contracted for without clients prior permission.

11. ASSIGNMENT. Neither client or CEI may delegate, assign, sublet or transfer its duties or interest in this agreement without the prior written consent of the other party.

12. OWNERSHIP OF DOCUMENTS. All reports, boring logs, field data, field notes, laboratory test data, calculations, estimates and other documents prepared by CEI, as instruments or service, shall remain the property of CEI. Client agrees that under no circumstances shall any documents or reports produced by CEI pursuant to this Agreement be used at any location or for any project not expressly provided for in this agreement without the written permission of CEI. Client agrees that all reports and other work furnished to client or its agents, which are not paid for, will be returned upon demand and will not be used by client for any purpose whatsoever. CEI will retain all pertinent written records relating to the services performed for a period of five (5) years following submission of the report, during which period the records will be made available to client at all reasonable times. During this five (5) year period, CEI will provide client with copies of documents created in the performance of the work, at the expense of client.

13. TERMINATION. This agreement may be terminated by either party upon fourteen (14) days written notice in the event of material failure by the other party to perform in accordance with the terms hereof. Such termination shall not be effective if the material failure has been remedied before the expiration of the period specified in the written notice. In the event of termination, CEI shall be paid for all services performed and expenses incurred up to the termination notice data plus reasonable termination expenses. The expenses of termination or suspension shall include all direct costs or CEI in completing such analysis, records and reports.

14. GOVERNING LAW. This agreement shall be governed and construed in accordance with the laws of the State of Alabama, United States of America.

15. SEPARABILITY. The provisions of this agreement are separate and divisible, and, if any court of competent jurisdiction shall determine that any provision hereof is void and/or unenforceable, the remaining provisions shall be construed and shall be valid as if the void and/or unenforceable provisions or were not included in this Agreement.

16. WAIVER. Except as otherwise especially provided in this Agreement, no failure on the part of either party to exercise, and no delay in exercising, any rights, privilege or power under this Agreement shall operate as a waiver or relinquishment thereof, nor shall any single partial exercise by either party or any right, privilege or power under this Agreement preclude any other or further exercise thereof, or the exercise of any right, privilege or power. Waiver by any party of any breach of any provisions of the Agreement shall not constitute or be construed as a continuing waiver, or a waiver of any other breach of any provision of this Agreement.

17. BINDING. This agreement shall be binding upon all of the parties and their respective estates, heirs, administrators, executors, successors and assigns.

18. STIPULATION. Each of the parties to this Agreement as set forth herein and in the Work Order furnished by CEI stipulates that they have read, understand and agree to be bound by all of the terms set forth pursuant to the documents which are the basis of this agreement.

(Revised 10/26/20)

DOCUMENT 00 41 13 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.1 BID INFORMATION

- A. Bidder: _____
- B. Project Name: A New Worship Facility for Tabernacle Baptist Church.
- C. Project Location: Broad Street, Selma, Alabama.
- D. Owner: Tabernacle Baptist Church.
- E. Owner Project Number: N/A.
- F. Architect: EXFORD ARCHITECTS.
- G. Architect Project Number: 10238.00.

1.2 CERTIFICATIONS AND BASE BID

- A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Exford Architects and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:
 - 1. _____Dollars (\$_____).
 - 2. The above amount may be modified by amounts indicated by the Bidder on the attached Document 004322 "Unit Prices Form" and Document 004323 "Alternates Form."

1.3 BID GUARANTEE

- A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:
 - 1. _____ Dollars (\$_____).

DOCUMENT 00 41 13 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 SUBCONTRACTORS AND SUPPLIERS

- A. The following companies shall execute subcontracts for the portions of the Work indicated:
 - 1.
 Concrete Work: _______.

 2.
 Masonry Work: _______.

 3.
 Roofing Work: _______.

 4.
 Plumbing Work: _______.

 5.
 HVAC Work: _______.

 6.
 Electrical Work: ______.

1.5 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within 365 calendar days.

1.6 ACKNOWLEDGMENT OF ADDENDA

- A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:
 - 1. Addendum No. 1, dated ______.
 - 2. Addendum No. 2, dated ______.
 - 3. Addendum No. 3, dated ______.
 - 4. Addendum No. 4, dated ______.

1.7 BID SUPPLEMENTS

- A. The following supplements are a part of this Bid Form and are attached hereto.
 - 1. Bid Form Supplement Alternates.
 - 2. Bid Form Supplement Unit Prices.
 - 3. Bid Form Supplement Allowances.
 - 4. Bid Form Supplement Bid Bond Form (AIA Document A310-2010).

DOCUMENT 00 41 13 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.8 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the City of Selma and the State of Alabama, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.9 SUBMISSION OF BID

A.	Respectfully submitted this	day of	, 2022.
B.	Submitted By:		(Name of bidding firm or corporation).
C.	Authorized Signature:		(Handwritten signature).
D.	Signed By:		(Type or print name).
E.	Title:		(Owner/Partner/President/Vice President).
F.	Witnessed By:		(Handwritten signature).
G.	Attest:		(Handwritten signature).
H.	By:		(Type or print name).
I.	Title:		(Corporate Secretary or Assistant Secretary).
J.	Street Address:		
K.	City, State, Zip:		
L.	Phone:		
M.	License No.:		
N.	Federal ID No.:		(Affix Corporate Seal Here).

END OF DOCUMENT 00 41 13

DOCUMENT 00 43 23 – ALTERNATES FORM

1.1 BID INFORMATION

- A. Bidder:
- B. Project Name: A New Worship Facility For Tabernacle Baptist Church.
- C. Project Location: 1500 Block of Broad Street, Selma, Alabama 36701.
- D. Owner: Tabernacle Baptist Church.
- E. Owner Project Number: N/A.
- F. Architect: Exford, LLC.
- G. Architect Project Number: 10238.00.

1.2 BID FORM SUPPLEMENT

A. This form is required to be attached to the Bid Form.

1.3 DESCRIPTION

- A. The undersigned Bidder proposes the amount below be added to or deducted from the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.
- B. If the alternate does not affect the Contract Sum, the Bidder shall indicate "NO CHANGE."
- C. If the alternate does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."
- D. The Bidder shall be responsible for determining from the Contract Documents the affects of each alternate on the Contract Time and the Contract Sum.
- E. Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within 60 calendar days of the Notice of Award unless otherwise indicated in the Contract Documents.
- F. Acceptance or non-acceptance of any alternates by the Owner shall have no affect on the Contract Time unless the "Schedule of Alternates" Article below provides a formatted space for the adjustment of the Contract Time.

	DOCUMENT 00 43 23 – ALTERNATES FORM						
1.4	SCHEDULE OF ALTERNATES						
А.	ALTERNATE NUMBER 1: CONSTRCTION OF BALCONY FLOOR STRUCTURE:						
	1. ADDDEDUCTNO CHANGENOT APPLICABLE 2. Dollars (\$).						
B.	ALTERNATE NUMBER 2: CONSTRUCTION OF SECOND FLOOR CLASSROOMS:						
	1. ADDDEDUCTNO CHANGENOT APPLICABLE 2. Dollars (\$).						
C.	ALTERNATE NUMBER 3: CONSTRUCTION OF NORTH PARKING LOT:						
	1. ADDDEDUCTNO CHANGENOT APPLICABLE 2. Dollars (\$).						
1.5	SUBMISSION OF BID SUPPLEMENT						
А.	Respectfully submitted this day of, 2022.						
B.	Submitted By:(Name of bidding firm or corporation).						
C.	Authorized Signature:(Handwritten signature).						
D.	Signed By:(Type or print name).						
E.	Title:(Owner/Partner/President/Vice President).						

END OF DOCUMENT 00 43 23

DOCUMENT 00 43 73 – PROPOSED SCHEDULE OF VALUES FORM

1.1 BID FORM SUPPLEMENT

A. A completed Proposed Schedule of Values form is required to be attached to the Bid Form.

1.2 PROPOSED SCHEDULE OF VALUES FORM

- A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, including alternates, in enough detail to facilitate continued evaluation of bid. Coordinate with the Project Manual table of contents. Provide multiple line items for principal material and subcontract amounts in excess of five percent of the Contract Sum.
- B. Arrange schedule of values using AIA Document G703-1992.
 - 1. Copies of AIA standard forms may be obtained from the American Institute of Architects; <u>https://www.aiacontracts.org/library</u>; (800) 942-7732.

END OF DOCUMENT 00 43 73

DOCUMENT 00 43 93 - BID SUBMITTAL CHECKLIST

1.1 BID INFORMATION

- A. Bidder: _____
- B. Project Name: A New Worship Facility For Tabernacle Baptist Church.
- C. Project Location: Broad Street, Selma, Alabama.
- D. Owner: Tabernacle Baptist Church.
- E. Owner Project Number: N/A.
- F. Architect: Exford Architects.
- G. Architect Project Number: 10238.00

1.2 BIDDER'S CHECKLIST

- A. In an effort to assist the Bidder in properly completing all documentation required, the following checklist is provided for the Bidder's convenience. The Bidder is solely responsible for verifying compliance with bid submittal requirements.
- B. Attach this completed checklist to the outside of the Submittal envelope.
 - 1. Used the Bid Form provided in the Project Manual.
 - 2. Prepared the Bid Form as required by the Instructions to Bidders.
 - 3. Indicated on the Bid Form the Addenda received.
 - 4. Attached to the Bid Form: Bid Supplement Form Allowances.
 - 5. Attached to the Bid Form: Bid Supplement Form Unit Prices.
 - 6. Attached to the Bid Form: Bid Supplement Form Alternates.
 - 7. Attached to the Bid Form: Proposed Schedule of Values Form.
 - 8. Attached to the Bid Form: Bid Bond OR a certified check for the amount required.
 - 9. Bid envelope shows name and address of the Bidder.
 - 10. Bid envelope shows the Bidder's Contractor's License Number.
 - 11. Bid envelope shows name of Project being bid.
 - 12. Bid envelope shows time and day of Bid Opening.
 - 13. Verified that the Bidder can provide executed Performance Bond and Labor and Material Bond.
 - 14. Verified that the Bidder can provide Certificates of Insurance in the amounts indicated.

END OF DOCUMENT 00 43 93

DOCUMENT 00 51 00 – NOTICE OF AWARD

1.1 BID INFORMATION

- A. Bidder: ______.
- B. Bidder's Address and telephone _____
- C. Prime Contract: General Construction.
- D. Project Name: New Worship Facility for Tabernacle Baptist Church.
- E. Project Location: Selma, Alabama.
- F. Owner: Tabernacle Baptist Church.
- G. Owner Project Number: N/A.
- H. Architect: Exford Architects.
- I. Architect Project Number: 10238.00.

1.2 NOTICE OF AWARD OF CONTRACT

- A. Notice: The above Bidder is hereby notified that their bid, dated ______, for the above Contract has been considered and the Bidder is hereby awarded a contract for the construction of the New Worship Facility for Tabernacle Baptist Church.
- B. Alternates Accepted: The following alternates have been accepted by Owner and have been incorporated in the Contract Sum:
 - 1.
 Alternate No. 1: ______.

 2.
 Alternate No. 2: ______.
- C. Contract Sum: The Contract Sum is _____ dollars (\$_____).

1.3 EXECUTION OF CONTRACT

A. Contract Documents: Copies of the Contract Documents will be made available to the Bidder immediately. The Bidder must comply with the following conditions precedent within 10 days of the above date of issuance of the Notice:

DOCUMENT 00 51 00 – NOTICE OF AWARD

- 1. Deliver to Owner three sets of fully executed copies of the Contract Documents.
- 2. Deliver with the executed Contract Documents Bonds and Certificates of Insurance required by the Contract Documents.
- B. Compliance: Failure to comply with conditions of this Notice within the time specified will entitle Owner to consider the Bidder in default, annul this Notice, and declare the Bidder's Bid security forfeited.
 - 1. Within 10 days after the Bidder complies with the conditions of this Notice, Owner will return to the Bidder one fully executed copy of the Contract Documents.

1.4 NOTIFICATION

- A. This Notice is issued by:
 - 1. Owner: <u>TABERNACLE BAPTIST CHURCH</u>.
 - 2. Authorized Signature:

(Handwritten signature).

- 3. Signed By: <u>Dr. Otis Dion Culliver</u>.
- 4. Title: <u>Pastor / Project Manager</u>.

END OF DOCUMENT 00 51 00
DOCUMENT 00 60 00 – PROJECT FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:
 - 1. AIA Document A105-2017 "Standard Short Form of Agreement between Owner and Contractor."
 - 2. The General Conditions are included in the Project Manual.
 - 3. The Supplementary Conditions for Project are separately prepared and included in the Project Manual.
 - 4. Owner's document(s) bound following this Document.

1.2 ADMINISTRATIVE FORMS

- A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.
- B. Copies of AIA standard forms may be obtained from the American Institute of Architects; www.aiacontractdocsaiacontracts.org; (800) 942-7732.
- C. Preconstruction Forms:
 - 1. Form of Performance Bond and Labor and Material Bond: AIA Document A312-2010 "Performance Bond and Payment Bond."
 - 2. Form of Certificate of Insurance: AIA Document G715-2017 "Supplemental Attachment for ACORD Certificate of Insurance 25."
- D. Information and Modification Forms:
 - 1. Form for Requests for Information (RFIs): AIA Document G716-2004 "Request for Information (RFI)."
 - 2. Form of Request for Proposal: AIA Document G709-2018 "Proposal Request."
 - 3. Change Order Form: AIA Document G701-2017 "Change Order."
 - 4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710-2017 "Architect's Supplemental Instructions."
 - 5. Form of Change Directive: AIA Document G714-2017 "Construction Change Directive."
- E. Payment Forms:
 - 1. Schedule of Values Form: AIA Document G703-1992 "Continuation Sheet."

DOCUMENT 00 60 00 – PROJECT FORMS

- 2. Payment Application: AIA Document G702-1992/703-1992 "Application and Certificate for Payment and Continuation Sheet."
- 3. Form of Contractor's Affidavit: AIA Document G706-1994 "Contractor's Affidavit of Payment of Debts and Claims."
- 4. Form of Affidavit of Release of Liens: AIA Document G706A-1994 "Contractor's Affidavit of Payment of Release of Liens."
- 5. Form of Consent of Surety: AIA Document G707-1994 "Consent of Surety to Final Payment."

END OF SECTION 00 60 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work under Owner's separate contracts.
 - 4. Owner-furnished/Contractor-installed (OFCI) products.
 - 5. Contractor's use of site and premises.
 - 6. Work restrictions.
 - 7. Specification and Drawing conventions.
- 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: A New Worship Facility for Tabernacle Baptist Church.
 - 1. Project Location: Broad Street, Selma, Alabama.
- B. Owner: Tabernacle Baptist Church.
 - 1. Owner's Representative: Dr. Otis Dion Culliver, Pastor.
- C. Architect: Exford Architects.

a.

- 1. Architect's Representative: Fredrick Woods, (205) 957-6640.
- D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

CIVIL ENGINEER:	CE Associates
	Chandra Abesingha, P.E.
	5229 Messer Airport Highway
	Birmingham, Alabama 35212
	Ph.:(205) 595-0401

b.	STRUCTURAL ENGINEER:	Smiley Structural Engineering Shayah Smiley, P.E. 410 Peachtree Parkway Suite 4245 Cumming, Georgia 30296 (678) 720-8769
c.	MECHANICAL ENGINEER:	OSEG, Inc. Chris Richard, P.E. 1664 Zebulon Court Riverdale, Georgia 30296 (404) 474-1628
d.	ELECTRICAL ENGINEER:	OSEG, Inc. McKinley Barnes 1664 Zebulon Court Riverdale, Georgia 30296 (404) 474-1628

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. The project consists of an 8,000 square foot worship facility with a balcony and partial second floor consisting of 3,400 square feet. The exterior walls shall consist of load bearing split faced CMU with texture facing the building interior, brick veneer and cavity insulation. Windows shall be metal clad wood and aluminum curtainwall with insulating glass. The ground floor shall consist of cast-in-place concrete. The interior walls shall be wood stud and the balcony and partial second floor shall consist of wood trusses with plywood decking. The ceilings shall be suspended acoustical ceiling and gypsum board bulkheads. Interior doors shall be hollow core wood in hollow metal door frames. Flooring shall be carpet tile and sheet vinyl in the Sanctuary, carpet tile in the offices, VCT in the Vestibule, Classrooms, and Corridors, porcelain tile in the toilets and hardwood flooring at the Pulpit.

The Project shall have a complete plumbing, (Including baptizing pool), Electrical, HVAC and Fire Alarm System. The existing concrete parking lot shall remain with an additional concrete parking lot constructed as an add alternate. There shall be minimal landscaping as shown on the drawings and other Work indicated in the Contract Documents.

The Occupancy Classification shall be Assembly 303, A-3.

B. Type of Contract:

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

1.4 PHASED CONSTRUCTION

- A. The Work shall be conducted in a single phase.
 - a. Commencement of Construction:
 - 1) Notice to Proceed: Work of this phase shall commence within 30 calendar days after the Notice to Proceed.
 - b. Substantial Completion:
 - 1) Within 365 calendar days after the Notice to Proceed.
- B. Before commencing Work, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates, and move-out and -in dates of Owner's personnel for the Work.

1.5 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.

1.6 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
 - 1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
 - 2. Provide for delivery of Owner-furnished products to Project site.
 - 3. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
 - 4. Obtain manufacturer's inspections, service, and warranties.
 - 5. Inform Contractor of earliest available delivery date for Owner-furnished products.

- B. Contractor's Responsibilities: The Work includes the following, as applicable:
 - 1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
 - 2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
 - 3. Receive, unload, handle, store, protect, and install Owner-furnished products.
 - 4. Make building services connections for Owner-furnished products.
 - 5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
 - 6. Repair or replace Owner-furnished products damaged following receipt.
- C. Owner-Furnished/Contractor-Installed (OFCI) Products:
 - 1. Sanctuary Seating.

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Unrestricted Use of Site: 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.
 - 1. Driveways, Walkways, and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
- B. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated.

- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.
- F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 - 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

DOCUMENT 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Unit-cost allowances.
 - 3. Quantity allowances.
 - 4. Contingency allowances.
- C. Related Requirements:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.

1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.3 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

DOCUMENT 01 21 00 - ALLOWANCES

- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.6 UNIT-COST ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

DOCUMENT 01 21 00 – ALLOWANCES

1.8 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
 - 3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lowerpriced materials or systems of the same scope and nature as originally indicated.

DOCUMENT 01 21 00 – ALLOWANCES

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. ALLOWANCE NUMBER ONE: Quantity Allowance: Include 350 cu. yd. of unsatisfactory soil excavation and disposal off-site and replacement with satisfactory soil material from off-site, as specified in Section 31 20 00 "Earth Moving."

The Geotechnical Engineer shall determine the suitability of earth pad under the mat by use of a loaded dump truck across the pad. Final price will be adjusted by the difference in material removed/replaced from 750 cubic yards as confirmed by the surveyor.

- 1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."
- B. ALLOWANCE NUMBER TWO: Include 50 cubic yards of rock excavation and disposal offsite and replacement with satisfactory soil material from off-site, as specified in Section 31 20 00 "Earth Moving".
- C. ALLOWANCE NUMBER THREE: Quantity Allowance: Include the sum of \$350.00 per thousand for the purchase and delivery of face brick, as specified in 04 20 00 "Unit Masonry" and shown on the drawings. Labor to install and clean, including all accessories, shall be included in the base bid.
- D. ALLOWANCE NUMBER FOUR: Quantity Allowance: Include the sum of \$18.00 per bag for brick veneer mortar.

DOCUMENT 01 21 00 - ALLOWANCES

END OF SECTION 01 21 00

DOCUMENT 01 22 00 – UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.

1.2 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

DOCUMENT 01 22 00 – UNIT PRICES

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. UNIT PRICE NUMBER ONE: Removal of unsatisfactory soil and replacement with satisfactory soil material.
 - 1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 31 20 00 "Earth Moving" and Section 01 21 00 "Allowances."
 - 2. Unit of Measurement: Per Cubic Yard of soil excavated, based on in-place surveys of volume before and after removal.
 - 3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 01 21 00 "Allowances."
- B. UNIT PRICE NUMBER TWO: Rock Removal.
 - 1. Description: Provide a unit price quote for rock encountered during construction. Price shall include removal of rock and hauling rock material away form the project site. Final pricing for quantities will be determined by the Geotechnical Engineer and / or the Surveyor.
 - 2. Unit of Measurement: Cubic Yard.
 - 3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 01 21 00 "Allowances."

END OF SECTION 01 22 00

DOCUMENT 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and related items incidental to or required for a complete installation whether indicated as part of alternate or not.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

DOCUMENT 01 23 00 – ALTERNATES

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. ALTERNATE NUMBER 1 – VOID.

B. ALTERNATE NUMBER 2 – CONSTRUCTION OF SECOND FLOOR CLASSROOMS:

- 1. Base Bid: The construction / installation of the second-floor structure but the exclusion of classroom walls, flooring, ceilings, doors and door frames, mechanical and electrical systems as shown on Drawing Sheet A2.2.
- 2. Alternate: Construction of the Second Floor Classroom walls finishes ceilings and doors as shown on Drawing Sheets A2.2, A6.2, D2.1, mechanical and electrical drawings.

C. ALTERNATE NUMBER 3 – CONSTRUCTION OF NORTH PARKING LOT:

- 1. Base Bid: Protection of the existing South concrete parking lot from damage during construction. Grade and plant grass seed in area to the North of the new building construction. Repair as required as indicated on the Civil Drawings.
- 2. Alternate: Construct new cast-in-place concrete parking lot to the North of the new building construction as indicated on the Civil Drawings.

END OF SECTION 01 23 00

DOCUMENT 01 25 00 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Document 002600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
 - 2. 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. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 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 form acceptable to Architect.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

DOCUMENT 01 25 00 – SUBSTITUTION PROCEDURES

- c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- e. Samples, where applicable or requested.
- f. Certificates and qualification data, where applicable or requested.
- g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
- h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
- j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- 1. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

DOCUMENT 01 25 00 – SUBSTITUTION PROCEDURES

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.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

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DOCUMENT 01 25 00 – SUBSTITUTION PROCEDURES

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

DOCUMENT 01 26 00 – 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 supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

DOCUMENT 01 26 00 – CONTRACT MODIFICATION PROCEDURES

- 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.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 WORK CHANGE DIRECTIVE

A. Work Change Directive: Architect may issue a Work Change Directive on form included in Project Manual. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

DOCUMENT 01 26 00 – CONTRACT MODIFICATION PROCEDURES

- 1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

DOCUMENT 01 29 00 – PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for 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. Arrange schedule of values consistent with format of AIA Document G703.
 - 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - 3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
 - 4. 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.
 - 5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
 - 6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 - 7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

DOCUMENT 01 29 00 - PAYMENT PROCEDURES

8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Payment Application Times: Submit Application for Payment to Architect by the of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. 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 for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. 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.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.

DOCUMENT 01 29 00 – PAYMENT PROCEDURES

- 2. When an application shows completion of an item, submit conditional final or full waivers.
- 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
- 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
- 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- G. 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. Products list (preliminary if not final).
 - 5. Sustainable design action plans, including preliminary project materials cost data.
 - 6. Schedule of unit prices.
 - 7. Submittal schedule (preliminary if not final).
 - 8. List of Contractor's staff assignments.
 - 9. List of Contractor's principal consultants.
 - 10. Copies of building permits.
 - 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 - 12. Initial progress report.
 - 13. Report of preconstruction conference.
- H. 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 Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. 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.
 - 5. AIA Document G706A.

DOCUMENT 01 29 00 – PAYMENT PROCEDURES

- 6. AIA Document G707.
- 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 01 29 00

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DOCUMENT 01 31 00 – 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. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. 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.
 - 2. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.2 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.3 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. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.

1.4 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 - 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to

accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

- 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
- 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
- 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
- 6. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 - 1. File Preparation Format:
 - a. Same digital data software program, version, and operating system as original Drawings.
 - b. DWG, Version, operating in Microsoft Windows operating system.
 - 2. File Submittal Format: Submit or post coordination drawing files using PDF format.
 - 3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in DWG/RVT.
 - c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.5 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 - 2. Coordinate and submit RFIs in a prompt manner 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. Owner name.
 - 2. Owner's Project number.
 - 3. Name of Architect.
 - 4. Architect's Project number.
 - 5. Date.
 - 6. Name of Contractor.
 - 7. RFI number, numbered sequentially.
 - 8. RFI subject.
 - 9. Specification Section number and title and related paragraphs, as appropriate.
 - 10. Drawing number and detail references, as appropriate.
 - 11. Field dimensions and conditions, as appropriate.
 - 12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 13. Contractor's signature.
 - 14. 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.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 - 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
 - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

- a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five 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 bi-monthly. Software log with not less than the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

1.6 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.
 - 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
 - 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 - 3. Digital Drawing Software Program: Contract Drawings are available in DWG/RVT.
 - 4. Contractor shall execute a data licensing agreement in the form of AIA Document C106.
 - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.
 - 5. The following digital data files will be furnished for each appropriate discipline:
 - a. Floor plans.
 - b. Reflected ceiling plans.
- B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
 - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

- 2. Name file with submittal number or other unique identifier, including revision identifier.
- 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
- B. Preconstruction Conference: Architect 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, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - 1. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Construction waste management and recycling.
 - w. Parking availability.
 - x. Office, work, and storage areas.
 - y. Equipment deliveries and priorities.
 - z. First aid.

- aa. Security.
- bb. Progress cleaning.
- 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- 4. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent and sustainable design coordinator; 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.
- 5. Agenda: Discuss items of significance that could affect meeting sustainable design requirements, including the following:
 - a. Sustainable design Project checklist.
 - b. General requirements for sustainable design-related procurement and documentation.
 - c. Project closeout requirements and sustainable design certification procedures.
 - d. Role of sustainable design coordinator.
 - e. Construction waste management.
 - f. Construction operations and sustainable design requirements and restrictions.
- 6. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect 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. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.

- k. Compatibility requirements.
- 1. Time schedules.
- m. Weather limitations.
- n. Manufacturer's written instructions.
- o. Warranty requirements.
- p. Compatibility of materials.
- q. Acceptability of substrates.
- r. Temporary facilities and controls.
- s. Space and access limitations.
- t. Regulations of authorities having jurisdiction.
- u. Testing and inspecting requirements.
- v. Installation procedures.
- w. Coordination with other work.
- x. Required performance results.
- y. Protection of adjacent work.
- z. 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 bi-monthly intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
DOCUMENT 01 31 00 – PROJECT MANAGEMENT AND COORDINATION

- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site use.
 - 10) Temporary facilities and controls.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of Proposal Requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
- 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. 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.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file.
 - 2. Two paper copies, of sufficient size to display entire period or schedule, as required.
- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of 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 each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
 - 3. Total Float Report: List of activities sorted in ascending order of total float.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at bi-monthly intervals.
- G. 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.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
 - 1. Use Microsoft Project for current Windows operating system.
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Commissioning Time: Include no fewer than 15 days for commissioning.
 - 6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 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.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:
 - 1. Temporary enclosure and space conditioning.
 - 2. Footing/Foundation Inspection
 - 3. Above Ceiling Inspection
 - 4. Pre-roofing Conference.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and the Contract Time.
- G. 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.
- H. 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. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- I. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.6 GANTT-CHART SCHEDULE REQUIREMENTS

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

1.7 CPM SCHEDULE REQUIREMENTS

- A. 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 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.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule 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 inspection.
 - j. Commissioning.
 - k. Punch list and final completion.
 - 1. Activities occurring following final completion.
- 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
- 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
- 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. 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.

1.8 REPORTS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 00

DOCUMENT 01 32 33 – PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Concealed Work photographs.
 - 3. Periodic construction photographs.
 - 4. Final completion construction photographs.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 024116 "Structure Demolition" for photographic documentation before building demolition operations commence.
 - 3. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

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. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Submit photos on CD-ROM or thumb-drive. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.
 - g. Unique sequential identifier keyed to accompanying key plan.

DOCUMENT 01 32 33 – PHOTOGRAPHIC DOCUMENTATION

- C. Printed Photographs: Submit two sets of prints of each photographic view within seven days of taking photographs.
 - 1. Format: 8-by-10-inch (203-by-254-mm) smooth-surface matte prints on single-weight, paper; enclosed back to back in clear plastic sleeves punched for three-ring binder. Include copy of key plan indicating each photograph's location and direction. Provide one binder for each set of prints.
 - 2. Identification: On back of each print, label with the following information:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken if not date stamped by camera.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.4 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. Metadata: Record accurate date and time and GPS location data from camera.
- D. File Names: Name media files with date, Project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs with maximum depth of field and in focus.

DOCUMENT 01 32 33 – PHOTOGRAPHIC DOCUMENTATION

- 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
 - 1. Underground utilities.
 - 2. Underslab services.
 - 3. Piping.
 - 4. Electrical conduit.
 - 5. Waterproofing and weather-resistant barriers.
- E. 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.
- F. Final Completion Construction Photographs: Take 50 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Architect.
 - 4. Name of Construction Manager.
 - 5. Name of Contractor.
 - 6. Name of firm or entity that prepared submittal.
 - 7. Names of subcontractor, manufacturer, and supplier.

- 8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
- 9. Category and type of submittal.
- 10. Submittal purpose and description.
- 11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
- 12. Drawing number and detail references, as appropriate.
- 13. Indication of full or partial submittal.
- 14. Location(s) where product is to be installed, as appropriate.
- 15. Other necessary identification.
- 16. Remarks.
- 17. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Paper Submittals:
 - 1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
 - 2. Provide a space approximately **6 by 8 inches (150 by 200 mm)** on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 - 3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
 - 4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
 - 5. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using AIA Document G810 transmittal form.
- E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

- 1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
- B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Resubmittal Review: Allow 15 days for review of each resubmittal.
- C. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- D. 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.
- E. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.

- b. Printed performance curves.
- c. Operational range diagrams.
- d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data 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.
 - Paper 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 30 by 42 inches (750 by 1067 mm).
 - a. Two opaque (bond) copies of each submittal. Architect will return one copy(ies).
 - b. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.

- 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
- 4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
- 5. Paper Transmittal: Include paper transmittal including complete submittal information indicated.
- 6. Disposition: Maintain sets of approved Samples at Project site, available for qualitycontrol 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.
- 7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 8. 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 will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
 - 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 - 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 - 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 - 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
 - 1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 - 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 - 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

- 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- 5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- 6. 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. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and 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.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.

- c. Demonstrate the qualities of products and workmanship.
- d. Demonstrate successful installation of interfaces between components and systems.
- e. Perform preconstruction testing to determine system performance.
- 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
- 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

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

1.5 ACTION SUBMITTALS

- A. Mockup Shop Drawings:
 - 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
 - 2. Indicate manufacturer and model number of individual components.
 - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

- 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.
- C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Statement on condition of substrates and their acceptability for installation of product.
 - 2. Statement that products at Project site comply with requirements.
 - 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. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

- 1. Statement that equipment complies with requirements.
- 2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
- 3. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
 - 1. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation

of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. 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. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated.
 - 2. Build mockups in location indicated or, if not indicated, as directed by Architect.
 - 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 - 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

- 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
- 10. Demolish and remove mockups when directed unless otherwise indicated.

1.9 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 - 1. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection 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 inspection 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. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.

- 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
- 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
- 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
- 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 6. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of

Owner, as indicated in the Statement of Special Inspections attached to this Section, and as follows:

- 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
- 2. Notifying Architect, 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 with copy to Contractor and to authorities having jurisdiction.
- 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
- 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- 6. Retesting and reinspecting corrected Work.

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, authorities' having jurisdiction reference during normal working hours.
 - 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

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

possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

- 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

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 indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. 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. The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC Associated Air Balance Council; <u>www.aabc.com</u>.
 - 2. AAMA American Architectural Manufacturers Association; <u>www.aamanet.org</u>.
 - 3. AAPFCO Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO American Association of State Highway and Transportation Officials; <u>www.transportation.org</u>.
 - 5. AATCC American Association of Textile Chemists and Colorists; <u>www.aatcc.org</u>.
 - 6. ABMA American Bearing Manufacturers Association; <u>www.americanbearings.org</u>.
 - 7. ABMA American Boiler Manufacturers Association; <u>www.abma.com</u>.
 - 8. ACI American Concrete Institute; (Formerly: ACI International); <u>www.concrete.org</u>.
 - 9. ACPA American Concrete Pipe Association; <u>www.concrete-pipe.org</u>.
 - 10. AEIC Association of Edison Illuminating Companies, Inc. (The); <u>www.aeic.org</u>.
 - 11. AF&PA American Forest & Paper Association; www.afandpa.org.
 - 12. AGA American Gas Association; <u>www.aga.org</u>.
 - 13. AHAM Association of Home Appliance Manufacturers; www.aham.org.
 - 14. AHRI Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 15. AI Asphalt Institute; <u>www.asphaltinstitute.org</u>.
 - 16. AIA American Institute of Architects (The); www.aia.org.
 - 17. AISC American Institute of Steel Construction; <u>www.aisc.org</u>.
 - 18. AISI American Iron and Steel Institute; <u>www.steel.org</u>.
 - 19. AITC American Institute of Timber Construction; <u>www.aitc-glulam.org</u>.
 - 20. AMCA Air Movement and Control Association International, Inc.; <u>www.amca.org</u>.
 - 21. ANSI American National Standards Institute; www.ansi.org.
 - 22. AOSA Association of Official Seed Analysts, Inc.; <u>www.aosaseed.com</u>.
 - 23. APA APA The Engineered Wood Association; <u>www.apawood.org</u>.

- 24. APA Architectural Precast Association; <u>www.archprecast.org</u>.
- 25. API American Petroleum Institute; <u>www.api.org</u>.
- 26. ARI Air-Conditioning & Refrigeration Institute; (See AHRI).
- 27. ARI American Refrigeration Institute; (See AHRI).
- 28. ARMA Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
- 29. ASCE American Society of Civil Engineers; <u>www.asce.org</u>.
- 30. ASCE/SEI American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
- 31. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers; <u>www.ashrae.org</u>.
- 32. ASME ASME International; (American Society of Mechanical Engineers); www.asme.org.
- 33. ASSE American Society of Sanitary Engineering; <u>www.asse-plumbing.org</u>.
- 34. ASSP American Society of Safety Professionals (The); <u>www.assp.org</u>.
- 35. ASTM ASTM International; <u>www.astm.org</u>.
- 36. ATIS Alliance for Telecommunications Industry Solutions; <u>www.atis.org</u>.
- 37. AVIXA Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); <u>www.soundandcommunications.com</u>.
- 38. AWEA American Wind Energy Association; www.awea.org.
- 39. AWI Architectural Woodwork Institute; <u>www.awinet.org</u>.
- 40. AWMAC Architectural Woodwork Manufacturers Association of Canada; <u>www.awmac.com</u>.
- 41. AWPA American Wood Protection Association; <u>www.awpa.com</u>.
- 42. AWS American Welding Society; <u>www.aws.org</u>.
- 43. AWWA American Water Works Association; www.awwa.org.
- 44. BHMA Builders Hardware Manufacturers Association; www.buildershardware.com.
- 45. BIA Brick Industry Association (The); <u>www.gobrick.com</u>.
- 46. BICSI BICSI, Inc.; <u>www.bicsi.org</u>.
- 47. BIFMA BIFMA International; (Business and Institutional Furniture Manufacturer's Association); <u>www.bifma.org</u>.
- 48. BISSC Baking Industry Sanitation Standards Committee; <u>www.bissc.org</u>.
- 49. BWF Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
- 50. CDA Copper Development Association; <u>www.copper.org</u>.
- 51. CE Conformite Europeenne; <u>http://ec.europa.eu/growth/single-market/ce-marking</u>.
- 52. CEA Canadian Electricity Association; www.electricity.ca.
- 53. CFFA Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
- 54. CFSEI Cold-Formed Steel Engineers Institute; <u>www.cfsei.org</u>.
- 55. CGA Compressed Gas Association; <u>www.cganet.com</u>.
- 56. CIMA Cellulose Insulation Manufacturers Association; www.cellulose.org.
- 57. CISCA Ceilings & Interior Systems Construction Association; <u>www.cisca.org</u>.
- 58. CISPI Cast Iron Soil Pipe Institute; <u>www.cispi.org</u>.
- 59. CLFMI Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
- 60. CPA Composite Panel Association; <u>www.compositepanel.org</u>.
- 61. CRI Carpet and Rug Institute (The); <u>www.carpet-rug.org</u>.

- 62. CRRC Cool Roof Rating Council; <u>www.coolroofs.org</u>.
- 63. CRSI Concrete Reinforcing Steel Institute; <u>www.crsi.org</u>.
- 64. CSA CSA Group; <u>www.csa-group.org</u>.
- 65. CSI Construction Specifications Institute (The); <u>www.csiresources.org</u>.
- 66. CSSB Cedar Shake & Shingle Bureau; www.cedarbureau.org.
- 67. CTA Consumer Technology Association; <u>www.cta.tech</u>.
- 68. CTI Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
- 69. CWC Composite Wood Council; (See CPA).
- 70. DASMA Door and Access Systems Manufacturers Association; <u>www.dasma.com</u>.
- 71. DHA Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); <u>www.decorativehardwoods.org</u>.
- 72. DHI Door and Hardware Institute; <u>www.dhi.org</u>.
- 73. ECA Electronic Components Association; (See ECIA).
- 74. ECAMA Electronic Components Assemblies & Materials Association; (See ECIA).
- 75. ECIA Electronic Components Industry Association; <u>www.ecianow.org</u>.
- 76. EIA Electronic Industries Alliance; (See TIA).
- 77. EIMA EIFS Industry Members Association; <u>www.eima.com</u>.
- 78. EJMA Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
- 79. EOS/ESD Association; (Electrostatic Discharge Association); <u>www.esda.org</u>.
- 80. ESTA Entertainment Services and Technology Association; (See PLASA).
- 81. ETL Intertek (See Intertek); www.intertek.com.
- 82. EVO Efficiency Valuation Organization; <u>www.evo-world.org</u>.
- 83. FCI Fluid Controls Institute; www.fluidcontrolsinstitute.org.
- 84. FIBA Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
- 85. FIVB Federation Internationale de Volleyball; (The International Volleyball Federation); <u>www.fivb.org</u>.
- 86. FM Approvals FM Approvals LLC; www.fmglobal.com.
- 87. FM Global FM Global; (Formerly: FMG FM Global); <u>www.fmglobal.com</u>.
- 88. FRSA Florida Roofing, Sheet Metal Contractors Association, Inc.; <u>www.floridaroof.com</u>.
- 89. FSA Fluid Sealing Association; <u>www.fluidsealing.com</u>.
- 90. FSC Forest Stewardship Council U.S.; www.fscus.org.
- 91. GA Gypsum Association; <u>www.gypsum.org</u>.
- 92. GANA Glass Association of North America; (See NGA).
- 93. GS Green Seal; <u>www.greenseal.org</u>.
- 94. HI Hydraulic Institute; www.pumps.org.
- 95. HI/GAMA Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
- 96. HMMA Hollow Metal Manufacturers Association; (See NAAMM).
- 97. HPVA Hardwood Plywood & Veneer Association; (See DHA).
- 98. HPW H. P. White Laboratory, Inc.; <u>www.hpwhite.com</u>.
- 99. IAPSC International Association of Professional Security Consultants; <u>www.iapsc.org</u>.
- 100. IAS International Accreditation Service; <u>www.iasonline.org</u>.
- 101. ICBO International Conference of Building Officials; (See ICC).

- 102. ICC International Code Council; <u>www.iccsafe.org</u>.
- 103. ICEA Insulated Cable Engineers Association, Inc.; <u>www.icea.net</u>.
- 104. ICPA International Cast Polymer Association; <u>www.theicpa.com</u>.
- 105. ICRI International Concrete Repair Institute, Inc.; <u>www.icri.org</u>.
- 106. IEC International Electrotechnical Commission; <u>www.iec.ch</u>.
- 107. IEEE Institute of Electrical and Electronics Engineers, Inc. (The); <u>www.ieee.org</u>.
- 108. IES Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); <u>www.ies.org</u>.
- 109. IESNA Illuminating Engineering Society of North America; (See IES).
- 110. IEST Institute of Environmental Sciences and Technology; <u>www.iest.org</u>.
- 111. IGMA Insulating Glass Manufacturers Alliance; www.igmaonline.org.
- 112. IGSHPA International Ground Source Heat Pump Association; www.igshpa.org.
- 113. II Infocomm International; (See AVIXA).
- 114. ILI Indiana Limestone Institute of America, Inc.; www.iliai.com.
- 115. Intertek Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
- 116. ISA International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); <u>www.isa.org</u>.
- 117. ISAS Instrumentation, Systems, and Automation Society (The); (See ISA).
- 118. ISFA International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); <u>www.isfanow.org</u>.
- 119. ISO International Organization for Standardization; www.iso.org.
- 120. ISSFA International Solid Surface Fabricators Association; (See ISFA).
- 121. ITU International Telecommunication Union; www.itu.int.
- 122. KCMA Kitchen Cabinet Manufacturers Association; www.kcma.org.
- 123. LMA Laminating Materials Association; (See CPA).
- 124. LPI Lightning Protection Institute; <u>www.lightning.org</u>.
- 125. MBMA Metal Building Manufacturers Association; www.mbma.com.
- 126. MCA Metal Construction Association; www.metalconstruction.org.
- 127. MFMA Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
- 128. MFMA Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
- 129. MHI Material Handling Industry of America; <u>www.mhia.org</u>.
- 130. MIA Marble Institute of America; (See NSI).
- 131. MMPA Moulding & Millwork Producers Association; www.wmmpa.com.
- 132. MPI Master Painters Institute; <u>www.paintinfo.com</u>.
- 133. MSS Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; <u>www.mss-hq.org</u>.
- 134. NAAMM National Association of Architectural Metal Manufacturers; <u>www.naamm.org</u>.
- 135. NACE NACE International; (National Association of Corrosion Engineers International); www.nace.org.
- 136. NADCA National Air Duct Cleaners Association; <u>www.nadca.com</u>.
- 137. NAIMA North American Insulation Manufacturers Association; <u>www.naima.org</u>.
- 138. NALP National Association of Landscape Professionals; www.landscapeprofessionals.org.

- 139. NBGQA National Building Granite Quarries Association, Inc.; <u>www.nbgqa.com</u>.
- 140. NBI New Buildings Institute; <u>www.newbuildings.org</u>.
- 141. NCAA National Collegiate Athletic Association (The); www.ncaa.org.
- 142. NCMA National Concrete Masonry Association; www.ncma.org.
- 143. NEBB National Environmental Balancing Bureau; www.nebb.org.
- 144. NECA National Electrical Contractors Association; www.necanet.org.
- 145. NeLMA Northeastern Lumber Manufacturers Association; www.nelma.org.
- 146. NEMA National Electrical Manufacturers Association; www.nema.org.
- 147. NETA InterNational Electrical Testing Association; www.netaworld.org.
- 148. NFHS National Federation of State High School Associations; www.nfhs.org.
- 149. NFPA National Fire Protection Association; www.nfpa.org.
- 150. NFPA NFPA International; (See NFPA).
- 151. NFRC National Fenestration Rating Council; www.nfrc.org.
- 152. NGA National Glass Association (The); (Formerly: Glass Association of North America); <u>www.glass.org</u>.
- 153. NHLA National Hardwood Lumber Association; www.nhla.com.
- 154. NLGA National Lumber Grades Authority; <u>www.nlga.org</u>.
- 155. NOFMA National Oak Flooring Manufacturers Association; (See NWFA).
- 156. NOMMA National Ornamental & Miscellaneous Metals Association; www.nomma.org.
- 157. NRCA National Roofing Contractors Association; www.nrca.net.
- 158. NRMCA National Ready Mixed Concrete Association; www.nrmca.org.
- 159. NSF NSF International; <u>www.nsf.org</u>.
- 160. NSI National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
- 161. NSPE National Society of Professional Engineers; <u>www.nspe.org</u>.
- 162. NSSGA National Stone, Sand & Gravel Association; www.nssga.org.
- 163. NTMA National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
- 164. NWFA National Wood Flooring Association; www.nwfa.org.
- 165. NWRA National Waste & Recycling Association; www.wasterecycling.org.
- 166. PCI Precast/Prestressed Concrete Institute; www.pci.org.
- 167. PDI Plumbing & Drainage Institute; <u>www.pdionline.org</u>.
- 168. PLASA PLASA; (Formerly: ESTA Entertainment Services and Technology Association); www.plasa.org.
- 169. RCSC Research Council on Structural Connections; <u>www.boltcouncil.org</u>.
- 170. RFCI Resilient Floor Covering Institute; <u>www.rfci.com</u>.
- 171. RIS Redwood Inspection Service; <u>www.redwoodinspection.com</u>.
- 172. SAE SAE International; <u>www.sae.org</u>.
- 173. SCTE Society of Cable Telecommunications Engineers; <u>www.scte.org</u>.
- 174. SDI Steel Deck Institute; <u>www.sdi.org</u>.
- 175. SDI Steel Door Institute; <u>www.steeldoor.org</u>.
- 176. SEFA Scientific Equipment and Furniture Association (The); www.sefalabs.com.
- 177. SEI/ASCE Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
- 178. SIA Security Industry Association; <u>www.siaonline.org</u>.
- 179. SJI Steel Joist Institute; <u>www.steeljoist.org</u>.
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- 180. SMA Screen Manufacturers Association; <u>www.smainfo.org</u>.
- 181. SMACNA Sheet Metal and Air Conditioning Contractors' National Association; <u>www.smacna.org</u>.
- 182. SMPTE Society of Motion Picture and Television Engineers; <u>www.smpte.org</u>.
- 183. SPFA Spray Polyurethane Foam Alliance; www.sprayfoam.org.
- 184. SPIB Southern Pine Inspection Bureau; <u>www.spib.org</u>.
- 185. SPRI Single Ply Roofing Industry; <u>www.spri.org</u>.
- 186. SRCC Solar Rating & Certification Corporation; <u>www.solar-rating.org</u>.
- 187. SSINA Specialty Steel Industry of North America; www.ssina.com.
- 188. SSPC SSPC: The Society for Protective Coatings; <u>www.sspc.org</u>.
- 189. STI Steel Tank Institute; <u>www.steeltank.com</u>.
- 190. SWI Steel Window Institute; <u>www.steelwindows.com</u>.
- 191. SWPA Submersible Wastewater Pump Association; www.swpa.org.
- 192. TCA Tilt-Up Concrete Association; <u>www.tilt-up.org</u>.
- 193. TCNA Tile Council of North America, Inc.; www.tileusa.com.
- 194. TEMA Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
- 195. TIA Telecommunications Industry Association (The); (Formerly: TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
- 196. TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
- 197. TMS The Masonry Society; <u>www.masonrysociety.org</u>.
- 198. TPI Truss Plate Institute; www.tpinst.org.
- 199. TPI Turfgrass Producers International; www.turfgrasssod.org.
- 200. TRI Tile Roofing Institute; www.tileroofing.org.
- 201. UL Underwriters Laboratories Inc.; www.ul.com.
- 202. UNI Uni-Bell PVC Pipe Association; www.uni-bell.org.
- 203. USAV USA Volleyball; www.usavolleyball.org.
- 204. USGBC U.S. Green Building Council; www.usgbc.org.
- 205. USITT United States Institute for Theatre Technology, Inc.; www.usitt.org.
- 206. WA Wallcoverings Association; <u>www.wallcoverings.org</u>.
- 207. WCLIB West Coast Lumber Inspection Bureau; <u>www.wclib.org</u>.
- 208. WCMA Window Covering Manufacturers Association; www.wcmanet.org.
- 209. WDMA Window & Door Manufacturers Association; www.wdma.com.
- 210. WI Woodwork Institute; <u>www.wicnet.org</u>.
- 211. WSRCA Western States Roofing Contractors Association; www.wsrca.com.
- 212. WWPA Western Wood Products Association; <u>www.wwpa.org</u>.
- C. 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. This information is believed to be accurate as of the date of the Contract Documents.
 - 1. DIN Deutsches Institut fur Normung e.V.; <u>www.din.de</u>.
 - 2. IAPMO International Association of Plumbing and Mechanical Officials; <u>www.iapmo.org</u>.

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- 3. ICC International Code Council; <u>www.iccsafe.org</u>.
- 4. ICC-ES ICC Evaluation Service, LLC; <u>www.icc-es.org</u>.
- D. 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. Information is subject to change and is up to date as of the date of the Contract Documents.
 - 1. COE Army Corps of Engineers; <u>www.usace.army.mil</u>.
 - 2. CPSC Consumer Product Safety Commission; <u>www.cpsc.gov</u>.
 - 3. DOC Department of Commerce; National Institute of Standards and Technology; <u>www.nist.gov</u>.
 - 4. DOD Department of Defense; <u>www.quicksearch.dla.mil</u>.
 - 5. DOE Department of Energy; <u>www.energy.gov</u>.
 - 6. EPA Environmental Protection Agency; <u>www.epa.gov</u>.
 - 7. FAA Federal Aviation Administration; <u>www.faa.gov</u>.
 - 8. FG Federal Government Publications; <u>www.gpo.gov/fdsys</u>.
 - 9. GSA General Services Administration; <u>www.gsa.gov</u>.
 - 10. HUD Department of Housing and Urban Development; <u>www.hud.gov</u>.
 - 11. LBL Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; <u>www.eetd.lbl.gov</u>.
 - 12. OSHA Occupational Safety & Health Administration; <u>www.osha.gov</u>.
 - 13. SD Department of State; <u>www.state.gov</u>.
 - 14. TRB Transportation Research Board; National Cooperative Highway Research Program; The National Academies; <u>www.trb.org</u>.
 - 15. USDA Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; <u>www.ars.usda.gov</u>.
 - 16. USDA Department of Agriculture; Rural Utilities Service; <u>www.usda.gov</u>.
 - 17. USDOJ Department of Justice; Office of Justice Programs; National Institute of Justice; <u>www.ojp.usdoj.gov</u>.
 - 18. USP U.S. Pharmacopeial Convention; <u>www.usp.org</u>.
 - 19. USPS United States Postal Service; <u>www.usps.com</u>.
- E. 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. CFR Code of Federal Regulations; Available from Government Printing Office; <u>www.govinfo.gov</u>.
 - 2. DOD Department of Defense; Military Specifications and Standards; Available from DLA Document Services; <u>www.quicksearch.dla.mil</u>.
 - 3. DSCC Defense Supply Center Columbus; (See FS).
 - 4. FED-STD Federal Standard; (See FS).
 - 5. FS Federal Specification; Available from DLA Document Services; <u>www.quicksearch.dla.mil</u>.

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- a. Available from Defense Standardization Program; <u>www.dsp.dla.mil</u>.
- b. Available from General Services Administration; <u>www.gsa.gov</u>.
- c. Available from National Institute of Building Sciences/Whole Building Design Guide; <u>www.wbdg.org</u>.
- 6. MILSPEC Military Specification and Standards; (See DOD).
- 7. USAB United States Access Board; <u>www.access-board.gov</u>.
- 8. USATBCB U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. 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. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; <u>www.bearhfti.ca.gov</u>.
 - 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; <u>www.calregs.com</u>.
 - 3. CDHS; California Department of Health Services; (See CDPH).
 - 4. CDPH; California Department of Public Health; Indoor Air Quality Program; <u>www.cal-iaq.org</u>.
 - 5. CPUC; California Public Utilities Commission; <u>www.cpuc.ca.gov</u>.
 - 6. SCAQMD; South Coast Air Quality Management District; <u>www.aqmd.gov</u>.
 - 7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Integrated exterior mockups.
 - 2. Room mockups.

1.2 DEFINITIONS

- A. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as part of permanent construction, consisting of multiple products, assemblies, and subassemblies.
- B. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, testing and inspecting agency representative, and installers of major systems whose Work is included in integrated exterior and room mockups.
 - 2. Review coordination of equipment and furnishings provided by the Owner for room mockups.
 - 3. Review locations and extent of mockups.
 - 4. Review testing procedures to be performed on mockups.
 - 5. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and testing and maintain schedule for the Work.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior and room mockups.
- B. Delegated Design Submittal: For temporary structural supports for mockups not attached to building structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Room Mockup Coordination Drawings: Floor plans, elevations and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Preconstruction Test Reports: For integrated exterior, preconstruction laboratory mockups.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
- B. Build mockups to do the following:
 - 1. Verify selections made under Sample submittals.
 - 2. Demonstrate aesthetic effects.
 - 3. Demonstrate the qualities of products and workmanship.
 - 4. Demonstrate acceptable coordination between components and systems.
 - 5. Perform preconstruction testing, such as window air- and water-leakage testing.
- C. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.
 - 1. Build mockups of size indicated.
 - 2. Build mockups in location indicated or, if not indicated, as directed by Architect .
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 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.
- D. Notifications:
 - 1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
 - 2. Notify Architect 14 days in advance of the dates and times when mockups will be tested.
 - 3. Allow seven days for initial review and each re-review of each mockup.
- E. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.
 - 1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

- 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 COORDINATION

A. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design support structure for free-standing mockups.
- B. Structural Performance:
 - 1. Seismic Performance: Mockups and support structure to withstand the effects of earthquake motions determined in accordance with **ASCE/SEI 7**.
 - 2. Wind Loads: As indicated on Drawings.
- C. Mockup Testing Performance Requirements: Perform tests using design pressures and performance criteria indicated for assemblies and products that are specified in other Sections and incorporated into integrated exterior mockups.

2.2 INTEGRATED EXTERIOR MOCKUPS

- A. Construct integrated exterior mockups according to approved mockup Shop Drawings. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.
- B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.
- C. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.

- D. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.
- E. The Work of integrated exterior mockups includes, but is not limited to, the following:
 - 1. Precast architectural concrete.
 - 2. Masonry veneer.
 - 3. Stone cladding.
 - 4. Cold-formed metal framing and sheathing.
 - 5. Air and weather barriers.
 - 6. Thermal insulation.
 - 7. Through-wall flashing.
 - 8. Flashing and sheet metal trim.
 - 9. Joint sealants.
 - 10. Metal wall panels.
 - 11. Aluminum-framed entrances and storefront.
 - 12. Glazed curtain walls.
 - 13. Aluminum windows.
 - 14. Glazing.
- F. Photographic Documentation: Document construction of integrated exterior mockups with photographs in accordance with Section 013233 "Photographic Documentation." Provide photographs showing details of interface of different materials and assemblies.
 - 1. Document testing procedures, including water leakage and other deficiencies. Photograph modifications to component interfaces intended to correct deficiencies.
- G. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence the Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.
- H. Retain approved mockups constructed in place. Incorporate fully into the Work.

2.3 ROOM MOCKUPS

- A. Build room mockups according to approved mockup Shop Drawings to evaluate constructability, demonstrate the coordination of trades and sequencing of Work, and to demonstrate aesthetic requirements. Include each visible finish, component, and equipment item within room mockups; include operable lighting.
- B. Provide room mockups of the following rooms:
 - 1. Classroom.
 - 2. Patient care room.

- 3. Hotel guest room.
- 4. Residential apartment unit.
- C. The Work of room mockups includes, but is not limited to, the following:
 - 1. Millwork and casework.
 - 2. Doors and frames.
 - 3. Access doors and frames.
 - 4. Glazing.
 - 5. Metal framing.
 - 6. Gypsum board.
 - 7. Ceramic tiling.
 - 8. Acoustical ceilings.
 - 9. Resilient flooring.
 - 10. Painting.
 - 11. Registers and grilles.
 - 12. Wiring devices.
 - 13. Lighting.

PART 3 - EXECUTION

3.1 TESTING OF INTEGRATED EXTERIOR MOCKUPS

- A. Integrated Exterior Mockup Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested Work complies with or deviates from requirements.
- B. Integrated Exterior Mockup Testing Services: Perform the following tests in the following order:
 - 1. Water-Spray Test: Before installation of interior finishes has begun, test areas designated by Architect in accordance with AAMA 501.2 for evidence of water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - 2. Air Leakage: Test in accordance with ASTM E783 at 1.5 times the rate specified in "Mockup Testing Performance Requirements" Paragraph in "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - a. Perform a minimum of two tests in areas as directed by Architect.

- 3. Water Penetration: Test in accordance with ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Mockup Testing Performance Requirements" Paragraph in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and verify no evidence of water penetration.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and installations, including connections, and also to observe testing for the following systems and assemblies.
 - 1. Curtain wall specified in Section 084413 "Glazed Aluminum Curtain Walls."
- D. Integrated exterior mockup will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 01 43 39

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. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project 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. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- 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.
- D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

- 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
- 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- 3. Indicate methods to be used to avoid trapping water in finished work.

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 United States Access 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 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

- 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
- 3. Drinking water and private toilet.
- 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
- 5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: 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, safety shower and eyewash 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.
- E. Temporary 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.
 - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

- 1. Install electric power service underground unless otherwise indicated.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install land-based telephone line(s) for each field office.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- E. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- 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 touch up 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."
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- K. 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.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.
 - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
 - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

- 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
- 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- 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 materials approved by authorities having jurisdiction.
- G. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- 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 workday.
- 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 Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

- L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 3. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition 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.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: 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. Periodically collect and remove waste containing cellulose or other organic matter.
- 4. Discard or replace water-damaged material.
- 5. Do not install material that is wet.
- 6. Discard and replace stored or installed material that begins to grow mold.
- 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.7 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."

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DOCUMENT 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

END OF SECTION 01 50 00

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. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, inservice performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the

specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 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.

1.4 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.

1.5 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

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 meeting requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

- B. Product Selection Procedures:
 - 1. Sole 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.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
 - 2. Sole 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.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
 - 3. Limited List of Products: 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 not be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
 - 4. Non-Limited List of Products: 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.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
 - 5. Limited List of Manufacturers: 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 not be considered.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

- 6. Non-Limited List of Manufacturers: 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.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
- 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "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 a 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.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
 - 1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: 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 the following requirements:
 - 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 - 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.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
 - 1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 - 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

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's portion of the Work.
 - 6. Coordination of Owner-installed products.
 - 7. Progress cleaning.
 - 8. Starting and adjusting.
 - 9. Protection of installed construction.
 - 10. Correction of the Work.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for coordination of Owner-furnished products, and 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, replacing defective work, and final cleaning.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 INFORMATIONAL SUBMITTALS

- A. Certified Surveys: Submit two copies signed by land surveyor.
- B. Certificates: Submit certificate signed by professional engineer, certifying that location and elevation of improvements comply with requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.
- 1.5 QUALITY ASSURANCE
 - A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
 - 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, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 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.
 - C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 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 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, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a professional engineer experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

- 2. Establish limits on use of Project site.
- 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
- 4. Inform installers of lines and levels to which they must comply.
- 5. Check the location, level and plumb, of every major element as the Work progresses.
- 6. Notify Architect 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.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

- 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
- 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb, and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

- E. 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.
- F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

- 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.
 - 1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
 - 2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed products
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

3.8 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.

- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00
PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous construction waste.
 - 2. Recycling nonhazardous construction waste.
 - 3. Disposing of nonhazardous construction waste.
- B. Related Requirements:
 - 1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
 - 2. Section 047200 "Cast Stone Masonry" for disposal requirements for excess stone and stone waste.
 - 3. 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, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.4 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons (tonnes).
 - 4. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
 - 5. Quantity of waste recycled, both estimated and actual in tons (tonnes).
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements.

- B. If including refrigerant recovery in this Section, retain first "Refrigerant Recovery Technician Qualifications" Paragraph below and delete second paragraph. Refrigerant Recovery Technician Qualifications: Universal certified by EPA-approved certification program.
- C. Refrigerant Recovery Technician Qualifications: Comply with requirements in Section 024116 "Structure Demolition."
- D. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.6 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Transportation equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches (300 mm) or more.

3.2 SALVAGING DEMOLITION WASTE

- A. Comply with requirements in Section 024116 "Structure Demolition" for salvaging demolition waste.
- B. Salvaged Items for Sale and Donation: Permitted on Project site.
- C. Salvaged Items for Owner's Use:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.

3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
 - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
- D. Paint: Seal containers and store by type.

3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.
- C. Burning: Do not burn waste materials.
- D. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

END OF SECTION 01 74 19

DOCUMENT 01 77 00 - 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.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 3. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- 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.

DOCUMENT 01 77 00 - CLOSEOUT PROCEDURES

1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit sustainable design submittals not previously submitted.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 - 6. Advise Owner of changeover in utility services.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 9. Complete final cleaning requirements.

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- 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect 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.

1.5 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
 - 1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
 - 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list 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.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect 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.

1.6 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
 - 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:

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- a. Project name.
- b. Date.
- c. Name of Architect.
- d. Name of Contractor.
- e. Page number.
- 4. Submit list of incomplete items in the following format:
 - a. PDF Electronic File: Architect will return annotated file.

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit by email to Architect.
- D. Warranties in Paper Form:
 - 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 (215-by-280-mm) paper.
- E. 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.

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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. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. 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.
 - c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - d. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - e. Vacuum and mop concrete.
 - f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - h. Remove labels that are not permanent.
 - i. Wipe surfaces of mechanical and electrical equipment[, elevator equipment,] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - 1. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

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- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 77 00

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 manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
 - 2. Submit three paper copies. Architect will return two copies.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect 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.
- D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - 2. 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.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.

- 3. Name and address of Owner.
- 4. Date of submittal.
- 5. Name and contact information for Contractor.
- 6. Name and contact information for Construction Manager.
- 7. Name and contact information for Architect.
- 8. Name and contact information for Commissioning Authority.
- 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
- 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.5 EMERGENCY MANUALS

- 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. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- C. 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.
- D. 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.
- E. 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.

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.

- 4. Equipment function.
- 5. Operating characteristics.
- 6. Limiting conditions.
- 7. Performance curves.
- 8. Engineering data and tests.
- 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.
- C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format,

identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

- a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
- 3. Identification and nomenclature of parts and components.
- 4. List of items recommended to be stocked as spare parts.
- 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. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- H. 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.

1.8 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

DOCUMENT 01 78 39 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Section 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(s) 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(s) of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned Record Prints and three set(s) of file prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
 - c. Final Submittal:
 - 1) Submit one paper-copy set(s) of marked-up record prints.

DOCUMENT 01 78 39 – PROJECT RECORD DOCUMENTS

- 2) Submit Record Digital Data Files and three set(s) of Record Digital Data File plots.
- 3) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files and paper copies of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories and one paper copy of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 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. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.

DOCUMENT 01 78 39 – PROJECT RECORD DOCUMENTS

- 1. Details not on the original Contract Drawings.
- m. Field records for variable and concealed conditions.
- n. Record information on the Work that is shown only schematically.
- 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
- 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. 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 for the original Contract Drawings.
 - 2. Format: DWG, Version compatible with Architect, Microsoft Windows operating system.
 - 3. Format: Annotated PDF electronic file.
 - 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - 5. Refer instances of uncertainty to Architect for resolution.
 - 6. Architect will furnish Contractor with 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 into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file.
 - 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.
 - e. Name of Contractor.

DOCUMENT 01 78 39 - PROJECT RECORD DOCUMENTS

1.4 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 - 3. Note related Change Orders and Record Drawings where applicable.
- B. Format: Submit record specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
- C. Format: Submit Record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
 - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

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DOCUMENT 01 78 39 – PROJECT RECORD DOCUMENTS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper[and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:

- a. Emergency manuals.
- b. Systems and equipment operation manuals.
- c. Systems and equipment maintenance manuals.
- d. Product maintenance manuals.
- e. Project Record Documents.
- f. Identification systems.
- g. Warranties and bonds.
- h. Maintenance service agreements and similar continuing commitments.
- 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
- 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - 1. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.

- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 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. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
 - 1. Submit video recordings on CD-ROM or thumb drive.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
- E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 79 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of buildings and site improvements.
 - 2. Removing below-grade construction.
 - 3. Disconnecting, capping or sealing, and abandoning in-place site utilities.
 - 4. Salvaging items for reuse by Owner.

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. Engineering Survey: Submit engineering survey of condition of building.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.
 - 1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain.
- C. Schedule of building demolition activities with starting and ending dates for each activity.
- D. Predemolition photographs or video.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

STRUCTURE DEMOLITION

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 EPA-approved certification program.

1.7 FIELD CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. On-site storage or sale of removed items or materials is not permitted.
- F. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Section 31 20 00 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- C. 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.
- B. Salvaged Items: Comply with the following:
 - 1. Clean salvaged items of dirt and demolition debris.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to Be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - 3. Cut off pipe or conduit a minimum of **24 inches (610 mm)** below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
 - 4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 **PROTECTION**

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
- C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
- D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."
 - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 - 6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 - 7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION

- A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain fire watch during and for at least two hours after flame-cutting operations.
 - 3. Maintain adequate ventilation when using cutting torches.
 - 4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
 - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
- C. Explosives: Use of explosives is not permitted.
- D. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- E. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- F. Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet (1.5 m) outside footprint indicated for new construction.
 - 1. Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.
- G. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet (1.5 m) outside footprint indicated for new construction. Abandon utilities outside this area.

- H. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."
- I. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.
- J. Promptly repair damage to adjacent buildings caused by demolition operations.

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.
- B. Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION 02 41 16

DOCUMENT 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

- 1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
- 2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
- 3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1.4 ACTION SUBMITTALS

- A. Product Data: For each of the following.
 - 1. Portland cement.
 - 2. Fly ash.
 - 3. Slag cement.
 - 4. Blended hydraulic cement.
 - 5. Aggregates.
 - 6. Admixtures:
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DOCUMENT 03 30 00 - CAST-IN-PLACE CONCRETE

- a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
- 7. Vapor retarders.
- 8. Liquid floor treatments.
- 9. Curing materials.
- 10. Joint fillers.
- B. Design Mixtures: For each concrete mixture, include the following:
 - 1. Mixture identification.
 - 2. Minimum 28-day compressive strength.
 - 3. Durability exposure class.
 - 4. Maximum w/cm.
 - 5. Calculated equilibrium unit weight, for lightweight concrete.
 - 6. Slump limit.
 - 7. Air content.
 - 8. Nominal maximum aggregate size.
 - 9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
 - 10. Intended placement method.
 - 11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings:
 - 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.
- D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
 - 1. Concrete Class designation.
 - 2. Location within Project.
 - 3. Exposure Class designation.
 - 4. Formed Surface Finish designation and final finish.
 - 5. Final finish for floors.
 - 6. Curing process.
 - 7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Curing compounds.
 - 4. Vapor retarders.
 - 5. Joint-filler strips.
- B. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Portland cement.
 - 2. Fly ash.
 - 3. Slag cement.
 - 4. Blended hydraulic cement.
 - 5. Aggregates.
 - 6. Admixtures:
- C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
- D. Preconstruction Test Reports: For each mix design.
- E. Field quality-control reports.
- F. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 - 1. Include the following information in each test report:

- a. Admixture dosage rates.
- b. Slump.
- c. Air content.
- d. Seven-day compressive strength.
- e. 28-day compressive strength.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M).

PART 2 - PRODUCTS

- 2.1 CONCRETE, GENERAL
 - A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

- A. Cementitious Materials:
 - 1. Portland Cement: ASTM C150/C150M, Type I/II.
 - 2. Fly Ash: ASTM C618, Class C or F.
 - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
 - 4. Blended Hydraulic Cement: ASTM C595/C595M, Type IP, portland-pozzola cement.
- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.

- b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
- c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).
- 2. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
- 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- 4. Water-Reducing Admixture: ASTM C494/C494M, Type A.
- 5. Retarding Admixture: ASTM C494/C494M, Type B.
- 6. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
- 7. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
- 8. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
- 9. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- C. Water and Water Used to Make Ice: ASTM C94/C94M, potable [or] [complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4]

2.3 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 deg F (10 deg C): Black.
 - b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
 - c. Ambient Temperature Above 85 deg F (29 deg C): White.
- C. Curing Paper: 8-feet- (2438-mm-) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
 - 1. <u>Manufacturers:</u> 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. <u>Fortifiber Building Systems Group</u>.

D. Water: Potable or complying with ASTM C1602/C1602M.

2.4 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Floor Slab Protective Covering: 8-feet- (2438-mm-) wide cellulose fabric.
 - 1. <u>Manufacturers:</u> 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. <u>McTech Group, Inc</u>.

2.5 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, in accordance with ACI 301 (ACI 301M).
 - 1. Use a qualified 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. 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 and concrete with a w/cm below 0.50.

2.6 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
 - 1. Exposure Class: ACI 318 (ACI 318M) F1.
 - 2. Minimum Compressive Strength: **3000 psi (20.7 MPa)** at 28 days.
 - 3. Maximum w/cm: 0.50.
 - 4. Slump Limit: **5 inches** (**125 mm**), plus or minus **1 inch** (**25 mm**).
 - 5. Slump Flow Limit: 22 inches (550 mm), plus or minus 1.5 inches (40 mm).
 - 6. Air Content:
 - a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size.

2.7 CONCRETE MIXING

- A. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF 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.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
 - 3. 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.

3.2 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 - 2. Face laps away from exposed direction of concrete pour.
 - 3. Lap vapor retarder over footings and grade beams not less than 6 inches (150 mm), sealing vapor retarder to concrete.
 - 4. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
 - 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 - 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 - 7. Protect vapor retarder during placement of reinforcement and concrete.

a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches (150 mm) on all sides, and sealing to vapor retarder.

3.3 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 - 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface, where joint sealants, specified in Section 079200 "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.

3.4 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. 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.

- F. 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. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.5 FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes:
 - 1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by formfacing material.
 - a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
 - b. Remove projections larger than 1 inch (25 mm).
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
 - e. Apply to concrete surfaces not exposed to public view.
 - 2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by formfacing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
 - b. Remove projections larger than 1/4 inch (6 mm).
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 (ACI 117M) Class B.
 - e. Locations: Apply to concrete surfaces exposed to public view.
 - 3. ACI 301 (ACI 301M) Surface Finish SF-3.0:
 - a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
 - b. Remove projections larger than 1/8 inch (3 mm).
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 (ACI 117M) Class A.
 - e. Locations: Apply to concrete surfaces exposed to public view.

- B. Related Unformed Surfaces:
 - 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
 - 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.6 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish:
 - 1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
 - 2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch (6 mm) in one direction.
 - 3. Apply scratch finish to surfaces to receive concrete floor toppings.
- C. Float Finish:
 - 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with powerdriven floats or by hand floating if area is small or inaccessible to power-driven floats.
 - 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
- D. Trowel Finish:
 - 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 - 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 4. Do not add water to concrete surface.
 - 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
 - 6. 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.

- 7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3 mm)] [1/8 inch (3 mm)and also no more than 1/16 inch (1.6 mm) in 2 feet (610 mm).
- 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 thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
 - 1. Coordinate required final finish with Architect before application.
 - 2. 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 locations indicated on Drawings.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 - 2. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps as indicated on Drawings
 - 1. Apply in accordance with manufacturer's written instructions and as follows:
 - a. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications.
 - b. Tamp aggregate flush with surface, but do not force below surface.
 - c. After broadcasting and tamping, apply float finish.
 - d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
 - 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
 - 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
 - 3. 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. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

- 1. Cast-in inserts and accessories, as shown on Drawings.
- 2. Screed, tamp, and trowel finish concrete surfaces.

3.8 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
 - 2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
 - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
 - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 - 3. If forms remain during curing period, moist cure after loosening forms.
 - 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
 - 1. Begin curing immediately after finishing concrete.
 - 2. Interior Concrete Floors:

- a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 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 (300 mm), and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 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 (300 mm), and sealed by waterproof tape or adhesive.

- a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
- b) Cure for not less than seven days.
- 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- c. Floors to Receive Polished Finish: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- d. Floors to Receive Chemical Stain:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
 - 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
 - 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
 - 4) Leave curing paper in place for duration of curing period, but not less than 28 days.
- e. Floors to Receive Urethane Flooring:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - 2) Rewet absorptive cover, and cover immediately with polyethylene moistureretaining cover with edges lapped 6 inches (150 mm) and sealed in place.

- 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
- 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
- f. Floors to Receive Curing Compound:
 - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period.
 - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
- g. Floors to Receive Curing and Sealing Compound:
 - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.9 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 - 1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 - 2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

- a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
 - 1. Headed bolts and studs.
 - 2. Verification of use of required design mixture.
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
 - 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 - 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

- a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
- 2. Slump: ASTM C143/C143M:
 - a. 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.
 - b. Perform additional tests when concrete consistency appears to change.
- 3. Slump Flow: ASTM C1611/C1611M:
 - a. 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.
 - b. Perform additional tests when concrete consistency appears to change.
- 4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. 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 C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
- 6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 - a. 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 C31/C31M:
 - a. Cast and laboratory cure two sets of three 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
- 8. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of three laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. Test one set of three field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test to 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 laboratorycured cylinders, Contractor to 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 (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
- 11. 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.
- 12. Additional Tests:
 - a. Testing and inspecting agency to 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.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301 (ACI 301M), Section 1.6.6.3.
- 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within 72 hours of completion of floor finishing and promptly report test results to Architect.

3.11 PROTECTION

- A. Protect concrete surfaces as follows:
 - 1. Protect from petroleum stains.
 - 2. Diaper hydraulic equipment used over concrete surfaces.
 - 3. Prohibit vehicles from interior concrete slabs.
 - 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
 - 5. Prohibit placement of steel items on concrete surfaces.
 - 6. Prohibit use of acids or acidic detergents over concrete surfaces.

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- 7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
- 8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 03 30 00

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Preparation
- B. Concrete Placement
- C. Finishes
- D. Patching
- E. Defective Concrete
- F. Field Testing Concrete

1.2 RELATED SECTIONS

- A. Section 31 10 00 Site Clearing
- B. Section 31 20 00 Earth Moving
- C. Section 31 25 00 Erosion and Sedimentation Control
- D. Section 32 91 13 Site Restoration

1.3 REFERENCES

- A. ACI 304 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
- B. ACI 305 Hot Weather Concreting
- C. ACI 306 Cold Weather Concreting
- D. ACI 308 Standard Practice for Curing Concrete
- E. ACI 318 Building Code Requirements for Reinforced Concrete
- F. ACI 211.1 Recommended Practice for Selecting Proportions for Normal Weight Concrete
- G. ACI 347 Recommended Practice for Concrete Formwork
- H. ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures

CAST IN PLACE CONCRETE FOR SITE WORK

- I. ACI 503.1 Standard Specifications for Bonding Plastic Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with a Multi-Component Epoxy Adhesive
- J. ASTM B-221 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- K. ASTM C-33 Concrete Aggregates
- L. ASTM C-94 Ready-Mixed Concrete
- M. ASTM C-150 Portland Cement
- N. ASTM C-260 Air Entraining Admixtures for Concrete
- O. ASTM C-330 Lightweight Aggregate for Structural Concrete
- P. ASTM C-494 Chemical Admixtures for Concrete
- Q. ASTM C-618 Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
- R. ASTM C-948 Test Method for Dry and Wet Bulk Density, Water Absorption and Apparent Porosity of Thin Sections of Glass-Fiber-Reinforced Concrete
- S. ASTM D-994 Preformed Expansion Joint Filler for Concrete (Bituminous Type)
- T. ASTM D-1190 Concrete Joint Sealer, Hot-Poured Elastic Type
- U. ASTM D-1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
- V. ASTM D-1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.4 QUALITY ASSURANCE

- A. The Contractor shall perform Work in accordance with ACI 301 and ACI 318.
- B. The Contractor shall acquire cement and aggregates from the same source for all work.
- C. The Contractor shall conform to ACI 305 when concreting during hot weather.
- D. The Contractor shall conform to ACI 306 when concreting during cold weather.
- E. An independent testing services company selected and paid by the Owner, will be retained to perform testing services. If tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace, and retest at the Contractor's own expense.

1.5 SUBMITTALS

- A. Submit concrete mix design including the following:
 - a. Breakdown of material content per cubic yard of concrete.
 - b. Show dry weight of cement.
 - c. Show saturated surface-dried weights of fine and coarse aggregate.
 - d. Show weight of water.
 - e. List quantities, types, and names of admixtures.
 - B. Submit trial mix laboratory reports.
 - C. Submit product data on each admixture proposed.
 - 1) Submit certification of aggregate quality. Include statement for an independent lab that aggregates used are not reactive.

1.6 STORAGE

- A. The Contractor shall store cement at the site in an approved manner to prevent absorption of moisture or contamination.
- B. The Contractor shall store aggregates at the site in an approved manner to prevent inclusion of foreign materials in the concrete.
- C. The Contractor shall store admixtures in an approved manner to prevent contamination, evaporation, or damage. The Contractor shall protect liquid admixtures from freezing and from harmful temperature ranges.

1.7 QUALIFICATIONS FOR READY-MIX CONCRETE MANUFACTURER

A. Concrete shall be manufactured and delivered to the project site by a ready-mix manufacturer experienced in ready-mix concrete.

1.8 JOB CONDITIONS

- A. The Contractor shall follow methods outlined in ACI 306 if concrete is to be placed when the atmospheric temperature is expected to be less than 40°F.
- B. Calcium chloride will not be considered for approval as an accelerating admixture during cold weather construction.
- C. The Contractor shall follow methods outlined in ACI 305 if concrete is to be placed when the atmospheric temperature is expected to exceed 90°F.

D. Manufacturer's recommendations shall be strictly followed in regard to atmospheric temperature limitations during application of epoxy or acrylic polymer modified concrete materials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Class A concrete shall be formed reinforced concrete having a 28 day minimum compressive strength of 4000 pounds per square inch. Class A concrete shall be cast-in-place in forms for foundations, pipe collars, footings, piers, sidewalks, curb and gutter, headwalls, manhole, monolithic sewer, and similar structures.
- B. Class B concrete shall be non-formed, non-reinforced concrete having a 28-day minimum compressive strength of 3000 pounds per square inch. Class B concrete shall be used for trench bottom stabilization, pipe protection encasement, pipe collars, anchors, massive sections, and similar work. Other classes, types, or design for cast-in-place concrete may be specified in the Plans, or Special Conditions, or approved by the Engineer as circumstances require.
- C. Concrete ingredients shall be selected, proportioned, and mixed to produce a workable, homogeneous concrete.
- D. Concrete components shall conform to the minimum requirements of this section.

2.2 CONCRETE MATERIALS

- A. Portland Cement shall conform to the following:
 - 1. All water bearing structures shall conform to Type V ASTM C-150 including optional tables. Tri-calcium Aluminate shall not exceed 5%.
 - 2. Non- water bearing structures shall conform to the requirements of ASTM C-150, Type I.
 - 3. The Contractor shall use one brand of cement throughout the project unless otherwise acceptable to the Engineer.
- B. Fly Ash shall conform to the requirements of ASTM C-618, Type F.
- C. Normal weight aggregates shall conform to the requirements of ASTM C-33 and as specified in this section. The Contractor shall provide aggregates from a single source for exposed concrete.
 - 1. For exterior exposed surfaces, the Contractor shall not use fine or coarse aggregates containing spall-causing deleterious substances.

- 2. Local aggregates not in compliance with the soundness and durability requirements of ASTM C-33 shall not be used except with prior written approval of the Engineer, and provided it can be shown by special testing or a record of past performance that these aggregates produce concrete of adequate strength and durability. Aggregate soundness testing for fine and coarse aggregates shall be in accordance with ASTM C-88 using a sodium sulfate solution.
- D. Fine aggregates shall conform to the requirements of ASTM C-33. The content of material passing a number 200 sieve shall not exceed 4 percent. The Contractor shall use only clean, sharp, natural sand.
- E. Coarse aggregates shall be crushed limestone conforming to the requirements of ASTM C- 33. Crushed limestone for coarse aggregate shall consist of uncoated particles of sound, durable rock of uniform quality containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension). Content of material passing a number 200 sieve shall not exceed 0.5 percent. No surface, yellow or soft stone shall be permitted. The specific gravity of the stone shall not be less than 2.56.
- F. Water shall be clean and potable.
- G. The Contractor shall provide concrete admixtures which contain not more than 0.1 percent chloride ions.
 - 1. Water-reducing admixture shall conform to requirements of ASTM C-494, Type A.
 - 2. Air-entraining admixture shall conform to requirements of ASTM C-260, certified by manufacturer to be compatible with other required admixtures.
 - 3. High-range water-reducing admixture (Super Plasticizer) shall conform to requirements of ASTM C-494, Type F or Type G.
 - 4. Water-reducing, accelerating admixture shall conform to requirements of ASTM C-494, Type E.
 - 5. Water-reducing, retarding admixture shall conform to requirements of ASTM C-494, Type D.

2.3 RELATED MATERIALS

- A. Granular Base: The Contractor shall provide evenly graded mixture of fine and coarse aggregates with maximum particle size of 1" to provide, when compacted, a smooth and even surface below slabs on grade. Granular base shall be 6" thick.
- B. Sand Cushion: The Contractor shall provide 2" of clean, manufactured or natural sand between vapor barrier and underside of slab. Sand used in concrete shall be natural sand consisting of clean, hard, durable, uncoated grains. Sands containing lignite are not acceptable for exposed architectural concrete.
- C. Vapor Retarder: The Contractor shall provide vapor retarder cover over prepared base material where indicated below slabs on grade. The Contractor shall use only materials that are resistant to deterioration when tested in accordance with ASTM E-154.

- D. Vapor retarder shall consist of a Polyethylene sheet not less than 6 mils thick.
- E. Absorptive Cover: The Contractor shall provide burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M-182, Class 2, where required.
- F. Moisture-Retaining Cover: The Contractor shall provide one of the following complying with ASTM C-171, where required:
 - 1. Waterproof paper.
 - 2. Polyethylene-coated burlap.
- G. Liquid Membrane-Forming Curing Compound: The Contractor shall provide liquid-type membraneforming curing compound complying with ASTM C-309, Type I, Class A where required. Moisture loss shall not exceed 0.055gr./sq. cm. when applied at 200 sq. ft./gal.
- H. Water-Based Acrylic Membrane Curing Compound: The Contractor shall provide water-based acrylic membrane curing compound conforming to ASTM C-309, Type I, Class B.
- I. Bonding Compound: Bonding compound shall be polyvinyl acetate or acrylic base.
- J. Epoxy Adhesive: The Contractor shall provide epoxy adhesive conforming to ASTM C-881 two component material suitable for use on dry or damp surfaces. The Contractor shall provide material Type, Grade, and Class to suit project requirements.
- K. Sealer: The Contractor shall provide sealer conforming to the Ashford formula as manufactured by Curecrete Chemical Company, Inc., or equal.
- L. Joint Fillers: The Contractor shall provide resilient premolded bituminous impregnated fiberboard units complying with ASTM D 1751, Type II, Class A; or AASHTO M 153, Type I.
- M. Joint Sealing Compound: Shall Conform to the following:
 - 1. Cold-Applied Rubber- Asphalt, ASTM C1850.
 - 2. Hot-Pour Rubber- Asphalt, ASTM C1190.
 - 3. Elastomeric Hot-Pour Sealant, ASTM D3406 (Highways).
 - 4. Coal Tar/PVC Hot- Pour Sealant, Federal Specifications SS-S-1614 (Fuel Resistant).
 - 5. Hot-Pour Joint Sealing Compound, ASTM D 3405.
- N. Water Stops: The Contractor shall provide PVC, serrated certerbulb-type waterstops, six (6) inches wide by not less than inch thickness, per Corps. Of Engineers CRD-C 572. Acceptable manufacturers are:

- 1. Greenstreak Plastic Products Co.
- 2. W.R. Meadows, Inc.
- 3. Grace Construction Products Co.
- O. Forms shall be in accordance with Section 03100 Concrete Formwork.

2.4 PROPORTIONING AND DESIGN OF MIXES

- A. Concrete mix design for particular applications shall be submitted to the Engineer for approval.
- B. An independent testing laboratory acceptable to the Owner for preparing and reporting proposed mix designs shall prepare design mixes for each type and strength of concrete by laboratory trial batch methods as specified in ACI 301.
- C. Design mixes shall provide normal weight, air-entrained concrete with the following properties, as indicated on the Plans, per ASTM C-94.
 - 1. Cement: Type V ASTM C-150 including optional tables. Tri-calcium Aluminate for all water bearing structures and surfaces shall not exceed 5%. Type I may be used for non-water bearing structures.
 - 2. Admixtures:

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- a. Air entraining shall conform to ASTM C-260.
- b. Pozzolans shall conform to ASTM C-618.
- c. Admixtures other than air-entraining agents and pozzolans shall be used only when authorized in writing by the Engineer.
- 3. Coarse Aggregate shall be Number 57, conforming to ASTM C-33.
- 4. Fine Aggregate shall conform to ASTM C-33.
- 5. Slump shall be between 3 and 5 inches.
- 6. Air content shall be $6\% \pm 1\%$ conforming to ASTM C-94.

. N	Aix Proportioning: One Cubic Yard	Class A	Class B
a.	Minimum 28 day compressive strength (psi)	4000	3000
b	 Cement per cubic yard Concrete (lbs). Minimum 	517	423
C	2. Maximum Pozzolan (fly ash) (lbs/cubic yard)	N/A 100	517 N/A
0.		100	1.011

d. Volume of water per cu. ft. of cement -Maximum (Gal) * 7.5 *Water to cement ratio for all water bearing structures and surfaces shall be in the range of 0.45 to 0.48.

e. Amount of air entrained in fresh mix as per ASTM C-0 94 (LR)

2.5 CONCRETE MIXING

- A. Ready-mix concrete shall comply with requirements of ASTM C-94, and as specified.
- B. Mix concrete only in quantities for immediate use.
- C. Do not retemper or use set concrete.
- D. Type V cement shall be used for all sewage-containing structures.

2.6 REINFORCING MATERIAL FOR CAST IN PLACE CONCRETE

- A. Reinforcing bars shall conform to the requirements of ASTM A-615, A-616, or A-617. Reinforcing bars shall be grade 60 deformed bars, or as specified on the Plans.
- B. Welded wire fabric, or cold-drawn wire for concrete reinforcement shall conform to the requirements of ASTM A-185 or ASTM A-82, respectively.

PART 3 – EXECUTION

3.1 FORMS:

A. Forms, centering etc. shall be so constructed that the finished concrete will conform to the shapes, dimensions, grades indicated on drawings. They shall be properly braced or tied together to maintain position and shape, prevent leakage of mortar and to insure safety to workmen and passerby. Forms shall be so assembled that their removal will not damage the concrete.

3.2 PREPARATION

- B. The Contractor shall prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- C. In locations where new concrete is doweled to existing work, the Contractor shall drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.
- D. The Contractor shall coordinate the placement of joint devices with erection of concrete form work, and placement of form accessories.
- E. The Contractor shall coat contact surfaces of forms with an approved, nonresidual, low-VOC, formcoating compound before reinforcement is placed.
- F. The Contractor shall not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. The Contractor shall apply form-coating material in compliance with manufacturer's instructions.

G. The Contractor shall coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel form work is not acceptable.

3.2 JOINTS

- A. The Contractor shall locate and install construction joints as indicated or, if not indicated, so as not to impair strength and appearance of the structure, as acceptable to the Engineer.
- B. The Contractor shall use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- C. The Contractor shall construct isolation joints in slabs-on-ground at points of contact between slabs-onground and vertical surfaces, such as equipment bases and elsewhere as indicated.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. The Contractor shall set and build into Work anchorage devices and other embedded items required for other Work that is attached to or supported by cast-in-place concrete. The Contractor shall use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.
- B. The Contractor shall set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. The Contractor shall provide and secure units to support screed strips using strike-off templates or compacting-type screeds.
- C. All exposed formed concrete edges shall have ³/₄" chamfer unless otherwise noted.

3.4 CONCRETE PLACEMENT

- A. Prior to placing order for concrete, the Contractor shall inspect and complete form work installation, reinforcing steel, and items to be embedded or cast in. The Contractor shall notify other crafts to permit installation of their work; and cooperate with other trades in setting such work. In addition to other equipment required for placement, the Contractor shall provide standby vibrators (minimum of two (2) units) during all concrete placements.
- B. The Contractor shall comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.
- C. The Contractor shall deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, the Contractor shall provide construction joints as herein specified. The Contractor shall deposit concrete to avoid segregation at its final location.
- D. The concrete shall be placed in such a manner to produce solid concrete free of honeycomb, and sand streaks. Concrete shall not be allowed to drop freely a distance greater than 5 feet. Concrete shall be compacted with mechanical vibrating equipment supplemented by hand spading, and tamping. It shall be placed upon clean, damp surfaces, free from water. Concrete which has contained its water content for CAST IN PLACE CONCRETE FOR SITE WORK 03 30 53 9

more than 60 minutes shall not be placed unless a variance is approved by the Engineer. Freshly placed concrete shall be protected from washy rain, flowing water, or other injurious conditions, and shall not be allowed to become dry from the time it is placed until the expiration of the 7-day curing period.

- E. The Contractor shall be required to have all necessary equipment, and supplies on site before starting a pour, including two vibrators, concrete buckets, pumps, cranes, and curing compounds as applicable.
- F. The Contractor shall deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, the Contractor
- G. The Contractor shall place each layer while the preceding layer is still plastic, to avoid cold joints. When placing concrete, use of aluminum pipe or other aluminum conveying devices will not be permitted. Maximum height of concrete free fall shall not exceed 5 feet. The Contractor shall use placement devices such as chutes, pouring spouts, and pumps as required. Concrete which has contained its water content for more than 60 minutes shall not be placed unless a variance is approved by the Engineer.
 - 1. The Contractor shall consolidate placed concrete by hand held mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. The Contractor shall use equipment and procedures for consolidation of concrete in accordance with ACI 309. Form vibrators are prohibited.
 - 2. The Contractor shall not use vibrators to transport concrete inside forms. The Contractor shall insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. The Contractor shall place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. The Contractor shall not insert vibrators into lower layers of concrete that have begun to set. At each insertion, the Contractor shall limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- H. The Contractor shall deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
 - 1. The Contractor shall consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. The Contractor shall bring slab surfaces to correct level with straightedge and strike off. The Contractor shall use bull floats prior to beginning finishing operations.
 - 3. The Contractor shall maintain reinforcing in proper position during concrete placement.
- I. The Contractor shall protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures in accordance with provisions of ACI 306.
- J. When air temperatures has fallen to or is expected to fall below 40°F (4°C), the Contractor shall uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C) and not more than 80°F (27°C) at point of placement.

- 1. The Contractor shall not use frozen materials or materials containing ice or snow, or place concrete on frozen subgrade or on subgrade containing frozen materials.
- 2. The Contractor shall not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- 3. The Contractor shall maintain the concrete at a temperature of not less than 50°F and not more than 90°F for a period not less than 72 hours.
- K. When hot weather conditions exist that would seriously impair quality and strength of concrete, the Contractor shall place concrete in compliance with ACI 305 and as herein specified.
 - 1. The Contractor shall cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F (32°C).
- L. All permanently exposed concrete work inside and outside shall be thoroughly rubbed with Carborundum stones to remove form marks, and other defects, and produce a smooth, uniform finish, no sooner than 24 hours, nor later than 72 hours after placement of the concrete or removal of forms. In lieu of rubbing the unfinished concrete, the Contractor may seal the concrete with a sealing compound approved by the Engineer.
- M. After concrete has been placed, it shall be protected against the loss of moisture, and from damage from other adjacent construction operations. The concrete shall be kept wet until forms have been removed. After forms have been removed, the concrete shall be rubbed as specified, and then wetted, and tightly covered with polyethylene film, or other approved curing material for a period of twenty-one (21) days in accordance with ASTM C-309 for curing concrete. It shall be the responsibility of the Contractor to maintain moisture in the concrete during the specified curing period.

3.5 FINISHES

- A. After striking-off and consolidating concrete, the Contractor shall smooth the surface by screeding and floating. Adjust floating to compact surface and produce uniform texture.
- B. After floating, the Contractor shall test the surface for trueness with a 10' 0"straight-edge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.
- C. The Contractor shall work edges of the formed joints with an edging tool, and round to 1/2" radius. The Contractor shall eliminate tool marks on the concrete surface.
- D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, the Contractor shall complete surface finishing, as shown in the Plans, as directed by the Engineer, or by performing one of the following below:

- 1. Broom finish by drawing a fine hair broom across the concrete surface. Repeat operation if required to provide fine line texture.
- 2. Coarse, nonslip finish by scoring surface with stiff-bristled broom.
- 3. Burlap finish by dragging a seamless strip of damp burlap across the concrete. Repeat operation to provide a gritty texture.
- 4. Trowel finish by dragging a trowel across the concrete surface to provide a smooth texture.

3.6 PATCHING

- A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.
- C. Patch imperfections as directed by the Engineer.

3.7 DEFECTIVE CONCRETE

- A. Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements shall be considered defective.
- B. The Contractor shall repair, or replace defective concrete as directed by the Engineer.
- C. The Contractor shall not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.8 FIELD TESTING CONCRETE

A. An independent testing services company selected and paid by the Owner, will be retained to perform testing services. If tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace, and retest at no cost to the Owner.

B. Strength Tests During the Work: Three concrete test cylinders for each fifty(50) cubic yards poured, or for each days pour, whichever amount of concrete is smaller. Cylinders will be made and tested in accordance with ASTM C-31, ASTM C-172, and ASTM C-39. The standard age of the test shall be 28 days. The first cylinder will be broken at seven (7) days. If the seven (7) day break exceeds the specified strength, then no further tests will be made until the twenty-eight (28) day. If the seven (7) day break does not meet the specified strength, then the second cylinder will be tested at the fourteen (14) day. In either event, the remaining cylinder(s) will be tested at the twenty-eight (28) day. When the test cylinders fail to conform to the compressive strength requirements, the Engineer shall have the

right to order a change in the concrete mix for the remaining portions of the Work at no additional cost to the Owner. The Contractor may wish to make additional cylinders at his own expense as verification.

- C. Test of Hardened Concrete in, or Removed From the Structure: When the results of the strength tests of the control specimens indicate the concrete as placed does not meet specification requirements, or where there is other evidence that the quality of the concrete is below specification requirements, core-boring tests shall be made in conformance with ASTM C-42.Core specimens will be tested by the Owner. All deficiencies shall be corrected; or, if the Contractor elects, he may submit a proposal, for approval, that load tests be made. If the proposal is approved, the load test shall be made by the Contractor, and the test results evaluated by the Engineer. If any concrete shows evidence of failure during the load test, or fails the core test as evaluated, the deficiency shall be corrected. Any deficiency shall be corrected in a manner approved by the Engineer, and at no additional cost to the Owner.
- D. During the concrete placement, the Testing Laboratory shall be responsible for making the test cylinders. The Contractor shall furnish the molds, and shall furnish a container suitable to the Testing Laboratory for storing cylinders in a moist or saturated condition, at the Contractor's expense.

END OF DOCUMENT 03 30 53

DOCUMENT 03 49 00 - GLASS FIBER REINFORCED CONCRETE COLUMNS

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Glass fiber reinforced concrete (GFRC) columns and accessories as indicated on the drawings.

1.2 RELATED SECTIONS

- A. Division 04 Section "Cast Stone".
- B. Division 05 Section "Metal Fabrications" for supplementary supports for large items.
- C. Division 06100 Section "Rough Carpentry" for supplementary supports for large items.
- D. Division 06 Section "Glass Fiber Reinforced Plastic Fabrications".
- E. Division 09 Section "Glass Fiber Reinforced Gypsum Fabrications".
- F. Division 09 Section "Paints and Coatings" for field painting and sealing prior to painting.

1.3 REFERENCES

- A. ASTM C 150 Standard Specification for Portland Cement; 1999a.
- B. ASTM C 33-99 Concrete Aggregates
- C. ASTM C 666 Standard test Method for Resistance of Concrete to Rapid Freezing and Thawing
- D. ASTM C 979-82(1993): Pigments for Integrally colored Concrete.
- E. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials; 1999.
- F. ASTM G 23 Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials; 1996.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including dimensions, finishes, storage and handling requirements and recommendations, and installation recommendations.

DOCUMENT 03 49 00 – GLASS FIBER REINFORCED CONCRETE COLUMNS

- C. Shop Drawings: For custom items, provide drawings showing dimensions, layout, joints, details, and interface with adjacent work; include field measured dimensions of the spaces where items are to be installed, if critical to proper installation.
- D. Samples: For each custom finish specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Obtain GFRC columns as manufactured by a firm specializing in the manufacture of GFRC columns, with a minimum of ten years experience.
- B. Provide a list of projects comparable in size, scope, and complexity as indicated.
- C. Provide verification that glass fiber reinforced concrete column meets or exceeds products specified.
- D. Installer Qualifications: Regularly engaged and experienced in the installation of glass fiber reinforced concrete columns.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Transport, lift, and handle units with care, avoiding excessive stress and preventing damage; use appropriate equipment.
- B. Store products in manufacturer's unopened packaging until ready for installation, in a clean dry area protected from weather, moisture and damage; store units upright and not stacked unless permitted by manufacturer. Product shall be stored clear of the ground on non-staining pallets or other temporary planking.
- C. Protect product from staining, chipping, and other damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Stromberg Architectural Products Inc; PO Box 8036, I-30 West, 4400 Oneal, Greenville, TX 75404. ASD. Tel: (903) 454-0904. Fax: (903) 454-3642. Email: sales@strombergarchitectural.com. www.strombergarchitectural.com.
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.
- 2.2 MATERIALS

DOCUMENT 03 49 00 – GLASS FIBER REINFORCED CONCRETE COLUMNS

- A. Glass Fiber Reinforced Concrete Columns: High density concrete made of ASTM C 150 Portland cement, crushed stone, silica sand, and polymers reinforced with glass fiber and structural reinforcing as required; asbestos free.
 - 1. Color: To match Architect's sample.
 - 2. Surface Texture: Exposed surface as selected from manufacturer's selection
 - 3. Capital Style: Doric.
 - 4. Column Shaft Style: Smooth.
 - 5. Overall Height: Field Verify.
 - 6. Column Diameter: Per Architectural Plan Detail.
 - 7. Base Style: As indicated on the Drawings.
 - 8. Base Shape: As indicated on the Drawings.
 - 9. Density: 140 pcf (2240 kg/cu m).
 - 10. Shell Thickness: 3/8" to 3/4 inch (9.5 mm), nominal.
 - 11. Surface Burning Characteristics: Flame spread index of 0, smoke developed index of 5; when tested in accordance with ASTM E 84. Fuel contribution of 3.
 - 12. Weather Resistance: No significant loss in strength or change in appearance after 200 hours accelerated weathering conducted in accordance with ASTM G 23.
 - 13. Flexural Strength: 1000 to 1800 psi (6.9 to 12.4 MPa).
 - 14. Modulus of Elasticity: 2 x 10^5 psi (1370 MPa).
 - 15. Compressive Strength: Over 5000 psi (34 MPa).
 - 16. Variation from Dimensions Indicated on Drawings: Plus and minus 1/8 inch (3 mm), maximum.
 - 17. Variation from Plane Along Edge or Surface: Plus and minus 1/16 inch per linear foot (1.5 mm in 300 mm), maximum.
 - 18. Outside Corner Radius: 1/16 inch to 1/8 inch (1.5 to 3 mm).
 - 19. Draft Angle: 3 degrees, minimum, on returns, setbacks, reveals, and grooves.
 - 20. Provide non-corrosive anchors and reinforced anchoring points as indicated on drawings.
 - a. Concealed Anchors: Hot-dipped Galvanized Steel unless otherwise indicated.
- B. Joint materials
 - 1. Elastomeric Joint sealant per Section 07.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly constructed; verify that substrates are plumb and true.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

DOCUMENT 03 49 00 - GLASS FIBER REINFORCED CONCRETE COLUMNS

- D. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Architect and wait for instructions before beginning installation.
- E. Verify that bearing surface is plumb and true.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install supplementary temporary and permanent supports as required for proper installation.

3.3 INSTALLATION

- A. Install in accordance with applicable code and manufacturer's recommendations, plumb and true to line; shim where necessary.
- C. Provide sealant joints between individual GFRC pieces at locations indicated on drawings:
 - 1. Sealant joints per Division 7 Section "Joint Sealants".
 - 2. Joint Width: (Select One) [3/8-inch] [¹/₂-inch] [as indicated on drawings].
- D. Patch exposed anchor points to match color and texture of unit.
- E. Clean GFRC units according to manufacturer's written instructions.
 - 1. Remove dirt, stains, excess sealant or other undesired materials.
 - 2. Protect surrounding materials and surfaces during cleaning.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
DOCUMENT 03 49 43 - GLASS FIBER REINFORCED CONCRETE DOMES AND CUPOLAS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glass fiber reinforced concrete (GFRC) dome fabrications as indicated on the drawings.

1.2 RELATED SECTIONS

- A. Section 05500 Metal Fabrications: Supplementary supports for large items.
- B. Section 06100 Rough Carpentry: Supplementary supports for large items.
- C. Section 09900 Paints and Coatings: Field painting and sealing prior to painting.

1.3 REFERENCES

- A. ASTM C 150 Standard Specification for Portland Cement; 1999a.
- B. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials; 1999.
- C. ASTM G 23 Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials; 1996.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including dimensions, finishes, storage and handling requirements and recommendations, and installation recommendations.
- C. Shop Drawings: For custom items, provide drawings showing dimensions, layout, joints, details, and interface with adjacent work; include field measured dimensions of the spaces where items are to be installed, if critical to proper installation.
- D. Samples: For each custom finish specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Obtain GFRC dome(s) as manufactured by a firm specializing in the manufacture of GFRC domes, with a minimum of ten years experience.
- B. Provide a list of projects comparable in size, scope, and complexity as indicated.
- C. Provide verification that glass fiber reinforced concrete dome meets or exceeds products specified.

DOCUMENT 03 49 43 - GLASS FIBER REINFORCED CONCRETE DOMES AND CUPOLAS

D. Installer Qualifications: Regularly engaged and experienced in the installation of glass fiber reinforced concrete or precast concrete units.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Transport, lift, and handle units with care, avoiding excessive stress and preventing damage; use appropriate equipment.
- B. Store products in manufacturer's unopened packaging until ready for installation, in a clean dry area protected from weather, moisture and damage; store units upright and not stacked unless permitted by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Stromberg Architectural Products Inc; PO Box 8036, I-30 West, 4400 Oneal, Greenville, TX 75404. ASD. Tel: (903) 454-0904. Fax: (903) 454-3642. Email: <u>sales@strombergarchitectural.com</u>. <u>www.strombergarchitectural.com</u>.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 – Substitution Procedures.

2.2 MATERIALS

- A. Glass Fiber Reinforced Concrete Fabrications: High density concrete made of ASTM C 150 Portland cement, crushed stone, silica sand, and polymers reinforced with glass fiber and structural reinforcing as required; asbestos free.
 - 1. Color: As selected from manufacturer's selection.
 - 2. Color: To match Architect's sample.
 - 3. Density: 140 pcf (2240 kg/cu m).
 - 4. Shell Thickness: 3/8" to ³/₄ inch (9.5 mm), nominal.
 - 5. Surface Burning Characteristics: Flame spread index of 0, smoke developed index of 5; when tested in accordance with ASTM E 84. Fuel contribution of 3.
 - 6. Weather Resistance: No significant loss in strength or change in appearance after 200 hours accelerated weathering conducted in accordance with ASTM G 23.
 - 7. Flexural Strength: 1000 to 1800 psi (6.9 to 12.4 MPa).
 - 8. Modulus of Elasticity: 2 x 10⁵ psi (1370 MPa).
 - 9. Compressive Strength: Over 5000 psi (34 MPa).
 - 10. Variation from Dimensions Indicated on Drawings: Plus and minus 1/8 inch (3 mm), maximum.
 - 11. Variation from Plane Along Edge or Surface: Plus and minus 1/16 inch per linear foot (1.5 mm in 300 mm), maximum.
 - 12. Outside Corner Radius: 1/16 inch to 1/8 inch (1.5 to 3 mm).
 - 13. Draft Angle: 3 degrees, minimum, on returns, setbacks, reveals, and grooves.
 - 14. Provide concealed anchorage points for plaster type wire anchors.
 - 15. Provide screwed or bolted anchors with reinforced holes through face of units.

DOCUMENT 03 49 43 - GLASS FIBER REINFORCED CONCRETE DOMES AND CUPOLAS

16. Provide anchors and reinforced anchoring points as indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly constructed; verify that substrates are plumb and true.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Architect and wait for instructions before beginning installation.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install supplementary temporary and permanent supports as required for proper installation.

3.3 INSTALLATION

- A. Install in accordance with applicable code and manufacturer's recommendations, plumb and true to line; shim where necessary.
- B. Provide control joints at not more than 35 feet (10.5 m) on center if not indicated on drawings.
- C. Provide expansion joints where moving joints in substrate occur.
- D. Patch exposed anchor points to match color and texture of unit.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cleaning the following:
 - 1. Unit masonry surfaces.
 - 2. Stone surfaces.

1.2 DEFINITIONS

A. Low-Pressure Spray: 100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s).

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

- A. Mockups: Prepare mockups of cleaning on existing surfaces to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Cleaning: Clean an area approximately 25 sq. ft. (2.3 sq. m) for each type of masonry and surface condition.
 - a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
 - b. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.

PART 2 - PRODUCTS

2.1 PAINT REMOVERS

- A. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, waterrinsable, solvent-type paste, gel, or foamed emulsion formulation, for removing paint coatings from masonry; containing no methanol or methylene chloride.
 - 1. <u>Manufacturers:</u> 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. <u>American Building Restoration Products, Inc</u>.
 - b. <u>Cathedral Stone Products, Inc</u>.
 - c. <u>Dumond Chemicals, Inc</u>.
 - d. EaCo Chem, Inc.
 - e. <u>PROSOCO, Inc</u>.

2.2 CLEANING MATERIALS

- A. Water: Potable.
- B. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.
- C. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.
- D. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
 - 1. <u>Manufacturers:</u> 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. <u>Cathedral Stone Products, Inc</u>.
 - b. <u>PROSOCO, Inc</u>.
 - c. <u>Price Research, Ltd. dba Charles Paint Research</u>.
- E. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.

- 1. <u>Manufacturers:</u> 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. <u>American Building Restoration Products, Inc</u>.
 - b. Cathedral Stone Products, Inc.
 - c. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
 - d. Dumond Chemicals, Inc.
 - e. <u>Hydroclean; Hydrochemical Techniques, Inc</u>.
 - f. <u>PROSOCO, Inc</u>.
 - g. <u>Price Research, Ltd. dba Charles Paint Research</u>.

2.3 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.
- B. Acidic Cleaner Solution for Nonglazed Masonry and Unpolished Stone: Dilute acidic cleaner with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended in writing by chemical-cleaner manufacturer.
 - 1. Stones: Use only on unpolished granite, unpolished dolomite marble, and siliceous sandstone.
- C. Acidic Cleaner for Glazed Masonry and Polished Stone: Dilute acidic cleaner with water to concentration demonstrated by testing that does not etch or otherwise damage glazed or polished surface, but not greater than that recommended in writing by chemical-cleaner manufacturer.
 - 1. Stones: Use only on polished granite and polished dolomite marble.

PART 3 - EXECUTION

3.1 **PROTECTION**

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - 1. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents

according to manufacturer's written instructions. Do not apply liquid strippable masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.

3.2 CLEANING MASONRY, GENERAL

- A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet (6 m) away by Architect.
- B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.
- C. Use only those cleaning methods indicated for each masonry material and location.
 - 1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
 - 2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.
 - a. Equip units with pressure gages.
 - b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
 - c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
 - d. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
- D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.
- E. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.
- F. Water-Spray Application Method: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- G. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray

application. Do not spray apply at pressures exceeding 50 psi (345 kPa). Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

- H. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
 - 1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.

3.3 PRELIMINARY CLEANING

- A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.
- B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, calking, asphalt, and tar.
 - 1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
 - 2. Remove paint and calking with alkaline paint remover.
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Repeat application up to two times if needed.
 - 3. Remove asphalt and tar with solvent-type paste paint remover.
 - a. Comply with requirements in "Paint Removal" Article.
 - b. Apply paint remover only to asphalt and tar by brush without prewetting.
 - c. Allow paint remover to remain on surface for 10 to 30 minutes.
 - d. Repeat application if needed.

3.4 PAINT REMOVAL

- A. Paint-Remover Application, General: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- B. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:

- 1. Remove loose and peeling paint using medium-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
- 2. Apply paint remover to dry, painted surface with trowel, spatula, or as recommended in writing by manufacturer.
- 3. Apply cover according to manufacturer's written instructions.
- 4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
- 5. Scrape off paint and remover.
- 6. Rinse with hot water applied by low-pressure spray to remove chemicals and paint residue.
- 7. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended by chemical-cleaner or afterwash manufacturer.
- 8. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
- 9. Retreat spots of remaining paint.
- C. Paint Removal with Solvent-Type Paste Paint Remover:
 - 1. Remove loose and peeling paint using medium-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 - 2. Apply thick coating of paint remover to painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush. Apply in one or two coats according to manufacturer's written instructions.
 - 3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 - 4. Rinse with hot water applied by medium-pressure spray to remove chemicals and paint residue.

3.5 CLEANING MASONRY

- A. Detergent Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
 - 3. Rinse with cold water applied by low-pressure spray to remove detergent solution and soil.
 - 4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
- B. Mold, Mildew, and Algae Removal:

- 1. Wet surface with [cold] [hot] water applied by low-pressure spray.
- 2. Apply mold, mildew, and algae remover by brush[or low-pressure spray].
- 3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
- 4. Rinse with [cold] [hot] water applied by [low] [medium] [high]-pressure spray to remove mold, mildew, and algae remover and soil.
- 5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.
- C. Nonacidic Gel Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Remove bulk of gel cleaner.
 - 5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 - 6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- D. Nonacidic Liquid Chemical Cleaning:
 - 1. Wet surface with hot water applied by low-pressure spray.
 - 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Rinse with hot water applied by medium-pressure spray to remove chemicals and soil.
 - 5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- E. Mild-Acid Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.
 - 5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

- F. Acidic Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply cleaner to surface in two applications by brush or low-pressure spray.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil. Rinse until all foaming, if any, stops and suds disappear.
 - 5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- G. One-Part Limestone Chemical Cleaning:
 - 1. Wet surface with cold water applied by low-pressure spray.
 - 2. Apply cleaner to surface by brush or low-pressure spray.
 - 3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
 - 4. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
 - 5. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil.

END OF SECTION 04 01 10

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Lintels.
 - 3. Brick.
 - 4. Mortar and grout materials.
 - 5. Reinforcement.
 - 6. Ties and anchors.
 - 7. Embedded flashing.
 - 8. Accessories.
 - 9. Mortar and grout mixes.

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 reinforcing steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R. Indicate elevations of reinforced walls.
- C. Samples: For each type and color of exposed masonry unit and colored mortar.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product and for masonry units, include material test reports substantiating compliance with requirements.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.

2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.5 QUALITY ASSURANCE

- A. Sample Panel Mockups: 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 typical exterior and interior walls in sizes approximately **48** inches (1219 mm) long by **48 inches (1219 mm)** high by full thickness.

1.6 FIELD 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 TMS 602.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. (6 m) vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 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.
- B. CMUs: ASTM C90, medium weight unless otherwise indicated.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi (14.8 MPa).
- C. Decorative CMUs: ASTM C90, normal weight.
 - 1. <u>Manufacturers:</u> 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. <u>York Building Products</u>.
 - 2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi (14.8 MPa).
 - 3. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph above.
 - 4. Pattern and Texture: Standard pattern, ground-face finish and Standard pattern, split-face finish.
- D. Pre-faced CMUs: ASTM C90, lightweight hollow units, with manufacturer's standard smooth resinous facing complying with ASTM C744.
 - 1. <u>Manufacturers:</u> 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. Echelon; an Oldcastle APG brand.
 - b. <u>York Building Products</u>.
 - 2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi (14.8 MPa).
 - 3. Size: Manufactured to dimensions specified in "CMUs" Paragraph above but with prefaced surfaces having 1/16-inch- (1.6-mm-) wide returns of facing to create 1/4-inch-(6.2-mm-) wide mortar joints with modular coursing.
 - 4. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 LINTELS

- A. Solid Concrete Masonry Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength of not less than that of CMUs.
- B. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 032000 "Concrete Reinforcing," and with reinforcing bars indicated.
- C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

Manufacturer: Arriscraft, Chateau Brown Architectural Linear Series Brick.

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.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for coldweather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
 - 1. <u>Manufacturers:</u> 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. $\underline{\text{Cemex S.A.B. de C.V}}$.
- b. Holcim (US) Inc.
- c. Lafarge North America Inc.
- d. Quikrete; The QUIKRETE Companies, LLC.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. <u>Manufacturers:</u> 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. <u>Davis Colors</u>.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. <u>Lanxess Corporation</u>.
 - d. <u>Solomon Colors Inc</u>.
- F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Colored Portland Cement-Lime Mix:
 - a. <u>Manufacturers:</u> 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) <u>Argos USA LLC</u>.
 - 2) <u>Holcim (US) Inc</u>.
 - 3) <u>Lehigh Hanson; HeidelbergCement Group</u>.
 - 2. Colored Masonry Cement:
 - a. <u>Manufacturers</u>: 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) <u>Argos USA LLC</u>.
 - 2) <u>Cemex S.A.B. de C.V</u>.
 - 3) <u>Fairborn Cement Company</u>.
 - 4) <u>Holcim (US) Inc</u>.
 - 5) <u>Lafarge North America Inc</u>.
 - 6) <u>Lehigh Hanson; HeidelbergCement Group</u>.
- G. Aggregate for Mortar: ASTM C144.

- 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- 2. For joints less than 1/4 inch (6.4 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
- H. Aggregate for Grout: ASTM C404.
- I. Epoxy Pointing Mortar: ASTM C395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. <u>Manufacturers:</u> 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. <u>Euclid Chemical Company (The); an RPM company</u>.
 - b. <u>GCP Applied Technologies Inc</u>.
- K. Water: Potable.

2.6 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).
- B. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
 - 1. Interior Walls: Hot-dip galvanized carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
 - 5. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (406 mm) o.c.
 - 7. Provide in lengths of not less than 10 ft. (3 m), with prefabricated corner and tee units.
 - 8. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches (102 mm) wide, plus two side rods at each wythe of masonry 4 inches (102 mm) wide or less.

C. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) diameter, stainless steel continuous wire.

2.7 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
 - 2. Stainless Steel Wire: ASTM A580/A580M, Type 316
 - 3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 - 4. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
 - 5. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (102 mm) wide.
 - 1. Wire: Fabricate from 1/4-inch- (6.4-mm-) diameter, stainless steel wire.
- D. 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- (6.4-mm-) diameter, stainless steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- (6.4-mm-) diameter, stainless steel wire.
- E. 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 channel slots in concrete and attached to tie section; formed from **0.109-inch-** (2.78-mm-) thick, stainless steel sheet.
 - a. **0.108-inch-** (2.74-mm-) thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
 - 2. Tie Section: Triangular-shaped wire tie made from **0.25-inch-** (6.4-mm-) diameter, stainless steel wire.

- F. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf (445 N) load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch (1.6 mm).
 - 2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0781-inch-(1.98-mm-) thick, stainless steel sheet.
 - 3. Fabricate wire ties from 0.25-inch- (6.4-mm-) diameter, stainless steel wire unless otherwise indicated.

2.8 EMBEDDED FLASHING

- A. Flexible Flashing: Use the following unless otherwise indicated:
 - 1. Copper-Fabric Flashing: 7 oz./sq. ft. (2 kg/sq. m) self-adhesive copper sheet bonded between two layers of glass-fiber cloth.

2.9 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vents: Use one of the following unless otherwise indicated:
 - 1. Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch (6.4 to 10 mm) in diameter, in length required to produce 2-inch (51-mm) exposure on exterior and 18 inches (457 mm) in cavity. Use only for weeps.
 - 2. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch (10-mm) OD by 4 inches (102 mm) long.
 - 3. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (10 by 38 by 89 mm) long.
 - 4. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3.2 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

- 5. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3.2 mm) less than depth of outer wythe; in color selected from manufacturer's standard.
- 6. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Rainscreen Drainage Mat: Sheets or strips not less than full depth of cavity thick and installed to full height of cavityto prevent weep holes from clogging with mortar.
 - a. <u>Manufacturers:</u> 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) Advanced Building Products Inc.
 - 2) <u>CavClear; a division of Archovations, Inc</u>.
 - 3) <u>Keene Building Products</u>.
 - 4) <u>Mortar Net Solutions</u>.
 - 5) <u>Wire-Bond</u>.
- F. Proprietary Acidic Masonry 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. <u>Manufacturers:</u> 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. <u>Diedrich Technologies, Inc.; a Hohmann & Barnard company</u>.
 - b. <u>EaCo Chem, Inc</u>.
 - c. <u>PROSOCO, Inc</u>.

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime mortar.

- 4. For reinforced masonry, use portland cement-lime 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. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S..
- C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Pigments shall not exceed 5 percent of masonry cement by weight.
 - 3. Mix to match Architect's sample.
- D. Grout for Unit Masonry: Comply with ASTM C476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C476, Table 1.
 - 3. Provide grout with a slump of **8 to 11 inches (203 to 279 mm)** as measured in accordance with ASTM C143/C143M.
- E. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

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. Mix units from several pallets or cubes as they are placed.
- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 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 (13 mm) or minus 1/4 inch (6.4 mm).
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (13 mm).
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6.4 mm) in a story height or 1/2 inch (13 mm) total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm), with a maximum thickness limited to 1/2 inch (13 mm).
 - 2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (10 mm) or minus 1/4 inch (6.4 mm).
 - 3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3.2 mm).

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 (102-mm) 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 cores in hollow CMUs with grout 24 inches (610 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Lay structural clay tile as follows:
 - 1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
 - 2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
 - 3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- (6.4- to 10-mm-) thick joints.
- D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch (6.4 mm) and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached and seismic anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed connector sections and continuous wire 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 (406 mm) o.c. vertically and 24 inches (635 mm) o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. (0.25 sq. m of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.6 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (152 mm).
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at corners by using prefabricated L-shaped units.

3.7 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 2 inches (51 mm) 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 (610 mm) o.c. vertically and 36 inches (914 mm) o.c. horizontally.

3.8 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At lintels and shelf angles, extend flashing 6 inches (152 mm) minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches (152 mm) minimum, to edge of next full unit and turn ends up not less than 2 inches (51 mm) to form end dams.
 - 3. Install metal drip edges and sealant stops with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 - 5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- 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 weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
 - 1. Use open-head joints to form weep holes.
 - 2. Space weep holes 24 inches (610 mm) o.c. unless otherwise indicated.
 - 3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
- E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

- F. Install cavity vents in head joints in exterior wythes at spacing indicated. Use open-head joints to form cavity vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.9 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches (1524 mm.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level 2 in TMS 402.
 - 1. Begin masonry construction only after inspectors have verified proportions of siteprepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.

- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- G. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

3.11 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch (19 mm). 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 (3.2 mm per 305 mm). 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.

3.12 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. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

- 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
- 6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
- 7. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

3.13 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soilcontaminated 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 (457 mm) of finished grade.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

SECTION 047200 - CAST STONE 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. Wall panels.
 - 2. Trim units.
 - 3. Decorative elements.
 - 4. Accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. 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.
- D. Samples:
 - 1. For each color and texture of cast stone required, **4 inches (100 mm)** square in size.
 - 2. For colored mortar.

1.4 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.5 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 CSI or APA or PCI for Group A, Category AT.

PART 2 - PRODUCTS

2.1 CAST STONE UNITS

- A. Cast Stone Units: Comply with ASTM C1364.
 - 1. Units shall be manufactured using the manufacturer's selected method.
 - 2. Wall Panels: Sizes as indicated on Drawings.
- B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 - 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 - 3. Provide drips on projecting elements unless otherwise indicated.
- C. Cure Units as Follows:
 - 1. Cure units in enclosed, moist curing room at 95 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) 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 (21 deg C) or above.
 - b. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.
- D. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- E. Colors and Textures: Match Architect's samples

2.2 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 316 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.

- B. Dowels: 1/2-inch- (12-mm-) diameter round bars, fabricated from Type 316 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM
- C. 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 cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.3 MORTAR MIXES

- A. Comply with requirements in Section 042000 "Unit Masonry for mortar mixes.
- B. Comply with ASTM C270, Proportion Specification.
 - 1. For setting mortar, use Type S.
 - 2. For pointing mortar, use Type S.
- C. Preblended dry mortar mix complying with ASTM C1714/C1714M and capable of producing mortar strength as indicated in ASTM C270.
 - 1. For setting mortar, use Type S.
 - 2. For pointing mortar, use Type S.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

2.4 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C1364.

PART 3 - EXECUTION

- 3.1 SETTING CAST STONE IN MORTAR
 - A. Set cast stone as indicated in TMS 604.
 - B. Install cast stone units to comply with requirements in Section 042000 "Unit Masonry."
 - C. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

- D. 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 copings and between other units with exposed horizontal surfaces open to receive sealant.
 - 5. Keep joints at shelf angles open to receive sealant.
- E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.
- F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
- G. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.
- H. Rake out joints for pointing with sealant to depths of not less than 3/4 inch (19 mm). Scrub faces of units to remove excess mortar as joints are raked.
- I. Provide sealant joints at head joints of 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 cast stone as indicated in TMS 604.
- B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 - 2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.
- C. Fill anchor holes with sealant.

- 1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
- D. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.
- 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 1/4 inch in 20 ft. (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
- B. Variation from Level: Do not exceed 1/4 inch in 20 ft. (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) 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 (1.5 mm), 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.

END OF SECTION 04 72 00

DOCUMENT 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Shear stud connectors, shop welded.
 - 3. Shrinkage-resistant grout.
- B. Related Requirements:
 - 1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. Structural-steel materials.
 - 2. High-strength, bolt-nut-washer assemblies.
 - 3. Shear stud connectors.
 - 4. Anchor rods.
 - 5. Threaded rods.
 - 6. Forged-steel hardware.
 - 7. Shop primer.
 - 8. Galvanized-steel primer.
 - 9. Etching cleaner.
 - 10. Galvanized repair paint.
 - 11. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.

DOCUMENT 05 12 00 - STRUCTURAL STEEL FRAMING

C. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Mill test reports for structural-steel materials, including chemical and physical properties.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
 - 1. Option 2: Fabricator's experienced steel detailer selects or completes connections in accordance with ANSI/AISC 303.
 - a. Select and complete connections using schematic details indicated and ANSI/AISC 360.

DOCUMENT 05 12 00 - STRUCTURAL STEEL FRAMING

C. Construction: Braced frame

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, Angles: ASTM A36/A36M.
- C. Plate and Bar: ASTM A36/A36M
- D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.
- E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

2.4 RODS

- A. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
 - 1. Finish: Plain
- B. Threaded Rods: ASTM A36/A36M
 - 1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C

2.5 FORGED-STEEL STRUCTURAL HARDWARE

2.6 PRIMER

- A. Steel Primer:
 - 1. Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
 - 2. SSPC-Paint 23, latex primer.

STRUCTURAL STEEL FRAMING
DOCUMENT 05 12 00 - STRUCTURAL STEEL FRAMING

3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.7 SHRINKAGE-RESISTANT GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

2.8 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

2.9 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.10 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 (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 4. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.

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C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
 - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 - 2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 4. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates Bearing Plates 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.

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- 4. Promptly pack shrinkage-resistant 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 grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

END OF SECTION 05 12 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preassembled steel stairs with metal treads.
 - 2. Steel tube railings and guards attached to metal stairs.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

1.3 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
 - 3. Include plan at each level.

1.4 INFORMATIONAL SUBMITTALS

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

METAL PAN STAIRS

- 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
- 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
- 3. Uniform and concentrated loads need not be assumed to act concurrently.
- 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
- 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.
- B. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
 - 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.2 METALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed) or ASTM A513/A513M.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

- 1. Provide galvanized finish for exterior installations and where indicated.
- 2. Style Designation: 3/4 number 13.

2.3 FASTENERS

- A. General: Provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.
 - 1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F593, and nuts, ASTM F594 (ASTM F836M).

2.4 MISCELLANEOUS MATERIALS

- A. Handrail Wall Brackets: Cast stainless steel, center of rail 3-1/8 inches (79.4 mm) from face of wall.
 - 1. <u>Manufacturers:</u> 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. Julius Blum & Co., Inc.
 - b. <u>The Wagner Companies</u>.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type II, Level 2, and compatible with topcoat.
- D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for [interior] [exterior] use;

noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

- 1. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.
 - a. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
- 2. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Architectural Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers as indicated on Drawings.
 - a. Stringer Size: As required to comply with "Performance Requirements" Article.
 - b. Provide closures for exposed ends of channel and rectangular tube stringers.
 - c. Finish: Shop primed.
 - 2. Construct platforms of steel plate or channel or rectangular **tube** headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
 - a. Provide closures for exposed ends of channel and rectangular tube framing.
 - b. Finish: Shop primed.
 - 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. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
 - 5. Steel Sheet: Uncoated, cold-rolled steel sheet.
 - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.6 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."
- B. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
 - 1. Rails and Posts: 1-5/8-inch- (41-mm-) diameter top and bottom rails and 1-1/2-inch- (38-mm-) square posts.
 - 2. Picket Infill: **3/4-inch-** (**19-mm-**) square pickets spaced to prohibit the passage of a 4inch (100-mm) diameter sphere.
- C. Welded Connections: Fabricate railings and guards with welded connections.
 - 1. Fabricate connections that are exposed to weather in a manner that excludes water.
 - a. Provide weep holes where water may accumulate internally.
 - 2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
 - 3. Weld all around at connections, including at fittings.
 - 4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 5. Obtain fusion without undercut or overlap.
 - 6. Remove flux immediately.
 - Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #4
 Good quality, uniform undressed weld with minimal splatter as shown in NAAMM AMP 521.
- D. Form changes in direction of railings and guards as follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
 - 2. By inserting prefabricated elbow fittings of radius indicated.
- E. 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.

2.7 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 - 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
 - a. Clean bottom surface of plates.
 - b. Set plates for structural members on wedges, shims, or setting nuts.
 - c. Tighten anchor bolts after supported members have been positioned and plumbed.
 - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkageresistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

- 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- 3. Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete.
 - 2. Center nosings on tread width.
- G. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
 - 1. Space posts at spacing indicated or, if not indicated, as required by design loads.
 - 2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
 - 4. Secure posts, rail ends, and guard ends to building construction as follows:
 - a. Anchor posts to steel by welding or bolting to steel supporting members.
 - b. Anchor handrail and guards ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.
- B. Attach handrails to wall with wall brackets.
 - 1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 2. Secure wall brackets to building construction as required to comply with performance requirements.

3.3 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

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DOCUMENT 05 51 13 - METAL PAN STAIRS

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 05 51 13

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel railings.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Handrail brackets.
 - 2. Shop primer.
 - 3. Intermediate coats and topcoats.
 - 4. Nonshrink, nonmetallic grout.
 - 5. Metal finishes.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish.
- 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. Qualification Data: For delegated-design professional engineer.
- B. Welding certificates.
- C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."

1.5 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. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.

1.6 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

1.7 STEEL RAILINGS

- A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.
- B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A36/A36M.

- D. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
 - 1. Style Designation: 3/4 number 13.

1.8 FASTENERS

- A. Fastener Materials:
 - 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941 (ASTM F1941M), Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
- B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

1.9 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast stainless steel center of handrail 2-1/2 inches (63.5 mm)] [3-1/8 inches (79.4 mm) from wall.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
 - 1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

- G. Intermediate Coats and Topcoats: Provide products that comply with Section 099113 "Exterior Painting."
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

1.10 FABRICATION

- A. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
 - 2. 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 welds to comply with NOMMA's "Voluntary Joint Finish Standards" for #3 welds; utilitarian appearance not subject to view, partially dressed weld with spatter removed.
 - 5. By inserting prefabricated elbow fittings.
- D. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- E. 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 (6 mm) or less.
- F. 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 crushresistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- G. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
- H. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.
- I. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
 - 1. Provide socket covers designed and fabricated to resist being dislodged.
 - 2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

1.11 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner and as follows.
 - 1. Comply with SSPC-SP 16.
 - 2. Exterior Railings: SSPC-SP 6/NACE No. 3.
 - 3. Railings Indicated To Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
 - 4. Railings Indicated To Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3.
 - 5. Other Railings: SSPC-SP 3.

- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime uncoated railings with universal shop primer indicated.
 - 2. Do not apply primer to galvanized surfaces.

PART 2 - EXECUTION

2.1 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

2.2 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) 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 flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
- D. Install removable railing sections, where indicated on Drawing, in slip-fit stainless steel sockets cast in concrete.

2.3 ATTACHING RAILINGS

- A. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.
- 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 wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
- C. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

2.4 CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 52 13

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Stainless steel decorative railings.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product lines of decorative metal railings assembled from standard components.
 - 2. Stainless steel cable and cable fittings.
 - 3. Handrail brackets.
 - 4. Nonshrink, nonmetallic grout.
 - 5. Anchoring cement.
 - 6. Metal finishes.
- B. Shop Drawings: Include plans, elevations, sections, and attachment details.
- 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. Qualification Data: For delegated-design professional engineer.
- B. Welding certificates.
- C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- D. Preconstruction test reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

- 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
- 2. AWS D1.2/D1.2M, "Structural Welding Code Aluminum."
- 3. AWS D1.6/D1.6M, "Structural Welding Code Stainless Steel."

PART 2 - PRODUCTS

2.1 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. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.3 STAINLESS STEEL DECORATIVE RAILINGS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
 - 1. <u>HDI Railings</u>.
- B. Tubing: ASTM A554, Grade MT 304.

DECORATIVE METAL RAILINGS

- C. Pipe: ASTM A312/A312M, Grade TP 304.
- D. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.
- E. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304.
- F. Flat Bar: ASTM A666, Type 304.
- G. Bars and Shapes: ASTM A276/A276M, Type 304.
- H. Stainless Steel Cable and Cable Fittings:
 - 1. <u>Manufacturers:</u> 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. <u>HDI Railings</u>.
 - 2. Cable: 7-by-19 wire cable made from wire complying with ASTM A492, Type 316.
 - 3. Cable Diameter: 1/4 inch (6.4 mm).
 - 4. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
 - 5. Intermediate Cable Supports: Stainless steel flat bar, 1/4-by-1-inch (6.4-by-25.4-mm), predrilled.

2.4 FASTENERS

- A. Fastener Materials:
 - 1. Stainless Steel Railing Components: Type 304 stainless steel fasteners.
 - 2. Dissimilar Metal Railing Components: Type 304 stainless steel fasteners.
- B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast stainless steel, center of handrail **3-1/8 inches (79.4 mm)** from face of railing.

- B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

2.6 FABRICATION

- A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Connections: Fabricate railings with welded or mechanical connections unless otherwise indicated.
- 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. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.
- D. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings.
- E. Form changes in direction as follows:1. by inserting prefabricated elbow fittings.
- F. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- G. 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 (6 mm) or less.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.
- I. Stainless Steel Cable Guard Infill: Fabricate cable guard infill assemblies in the shop to fieldmeasured dimensions with fittings machine swaged.
 - 1. Minimize amount of turnbuckle take-up used for dimensional adjustment, so maximum amount is available for tensioning cable.
 - 2. Tag cable assemblies and fittings to identify installation locations and orientations for coordinated installation.

2.7 STAINLESS STEEL FINISHES

- A. Stainless Steel Tubing Finishes:
 - 1. 180-Grit Polished Finish: Uniform, directionally textured finish.
- B. Stainless Steel Sheet and Plate Finishes:
 - 1. Directional Satin Finish: ASTM A480/A480M, No. 4.
 - 2. High-Luster Finish: ASTM A480/A480M, No. 7.
 - 3. Mirror Finish: ASTM A480/A480M, No. 8.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3 m).
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

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B. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

3.3 ATTACHING RAILINGS

- A. Attach railings to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.
- B. Secure wall brackets 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 wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
- C. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.4 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

END OF SECTION 05 73 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Shear wall panels.
 - 3. Wood blocking and nailers.
 - 4. Wood furring.
 - 5. Plywood backing panels.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of process and factory-fabricated product.
 - 2. For preservative-treated wood products.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates:
 - 1. 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.
 - 2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.
- 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. Post-installed anchors.
 - 7. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece. Revise subparagraph below if rough lumber is acceptable for all work.
 - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
 - 1. Boards: 19 percent.
 - 2. Dimension Lumber: 19 percent unless otherwise indicated.
 - 3. Timber. 19 percent.
 - 4. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE TREATMENT

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. 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, 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 (460 mm) above the ground in crawlspaces or unexcavated areas.
- 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions by Grade: Construction or No. 2 grade.
 - 1. Application: All interior partitions.
 - 2. Species:
 - a. Southern pine or mixed southern pine; SPIB.
 - b. Northern species; NLGA.
 - c. Eastern softwoods; NeLMA.
 - d. Western woods; WCLIB or WWPA.
- B. Framing Other Than Non-Load-Bearing Partitions by Grade: Construction or No. 2 grade.
 - 1. Application: Framing other than interior partitions not indicated as load bearing.
 - 2. Species:
 - a. Hem-fir (north); NLGA
 - b. Douglas fir-larch; WCLIB or WWPA.
 - c. Southern pine or mixed southern pine; SPIB.
 - d. Spruce-pine-fir; NLGA.
 - e. Douglas fir-south; WWPA.
 - f. Hem-fir; WCLIB or WWPA.
 - g. Douglas fir-larch (north); NLGA.
 - h. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - 1. Species and Grade: As indicated above for load-bearing construction of same type.

2.4 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
 - 2. Eastern softwoods; No. 2 Common grade; NeLMA.
 - 3. Northern species; No. 2 Common grade; NLGA.
 - 4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than **3/4-inch (19-mm)** nominal thickness.

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
 - 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: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC308 as appropriate for the substrate.

2.7 METAL FRAMING ANCHORS

- A. <u>Manufacturers:</u> 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. <u>Cleveland Steel Specialty Co</u>.
 - 2. <u>MiTek Industries, Inc</u>.
 - 3. <u>Phoenix Metal Products, Inc</u>.
 - 4. <u>Simpson Strong-Tie Co., Inc</u>.
 - 5. <u>Tamlyn</u>.
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), highstrength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.

2.8 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets:
 - 1. Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- D. Install shear wall panels to comply with manufacturer's written instructions.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. 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. ICC-ES evaluation report for fastener.

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 wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

DOCUMENT 06 15 16 – WOOD ROOF DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glued-laminated wood roof decking

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Research/Evaluation Reports: For glued-laminated wood roof decking indicated to be of diaphragm design and construction, from ICC-ES.

PART 2 - PRODUCTS

2.1 WOOD ROOF DECKING, GENERAL

- A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Face Species: Southern pine.
- C. Roof Decking Nominal Size: 4 by 8.
- D. Face Grade: Service: Face knot holes, stains, end splits, skips, roller splits, planer burns, and other nonstrength-reducing characteristics are allowed. Strength-reducing characteristics are not allowed.
- E. Moisture Content: Provide wood roof decking with 15 percent maximum moisture content at time of dressing.
- F. Face Surface: Smooth.
- G. Edge Pattern: Vee grooved.

DOCUMENT 06 15 16 – WOOD ROOF DECKING

2.2 ACCESSORY MATERIALS

- A. Fastener Material: Hot-dip galvanized steel.
- B. Sealants: Latex, complying with applicable requirements in Section 079200 "Joint Sealants" and recommended by sealant manufacturer and manufacturer of substrates for intended application.
 - 1. <u>Manufacturers:</u> 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. <u>Bostik; Arkema</u>.
 - b. <u>May National Associates, Inc.; a subsidiary of Sika Corporation</u>.
 - c. <u>Pecora Corporation</u>.
 - d. <u>Permathane; ITW Polymer Sealants North America</u>.
 - e. <u>Tremco Incorporated</u>.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install laminated wood roof decking to comply with manufacturer's written instructions.
 - 1. Locate end joints for controlled random lay-up.
 - Slant nail each course of glued-laminated wood roof decking to the tongue of the adjacent course at 30 inches (750 mm) o.c. and within 12 inches (300 mm) of the end of each unit. Stagger nailing 15 inches (380 mm) in adjacent courses.
 a. Use 10d nails for 4-by-6 and 4-by-8 roof decking.
- B. Anchor wood roof decking, where supported on walls, with bolts as indicated.
- C. Apply joint sealant to seal roof decking at exterior walls at the following locations:
 - 1. Between roof decking and supports located at exterior walls.
 - 2. Between roof decking and exterior walls that butt against underside of roof decking.
 - 3. Between tongues and grooves of roof decking over exterior walls and supports at exterior walls.

3.2 **PROTECTION**

A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.

DOCUMENT 06 15 16 - WOOD ROOF DECKING

END OF SECTION 06 15 16

DOCUMENT 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Subflooring.
 - 4. Underlayment.
 - 5. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated plywood.
 - 2. Fire-retardant-treated plywood.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

DOCUMENT 06 16 00 – SHEATHING

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials shall comply with requirements specified above for fireretardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. 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 D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings.

DOCUMENT 06 16 00 – SHEATHING

2.5 WALL SHEATHING

- A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, Exposure 1, Structural I sheathing.
- B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.
- C. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
 - 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - b. <u>Continental Building Products Inc</u>.
 - c. Georgia-Pacific Gypsum LLC.
 - d. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - e. <u>USG Corporation</u>.
 - 2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
- D. Cementitious Backer Units: ASTM C1325, Type A.
 - 1. <u>Manufacturers:</u> 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. <u>C-Cure</u>.
 - b. <u>Custom Building Products</u>.
 - c. <u>FinPan, Inc</u>.
 - 2. Thickness: **5/8 inch (15.9 mm)**.

2.6 ROOF SHEATHING

A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, Exposure 1, Structural I sheathing.

2.7 SUBFLOORING AND UNDERLAYMENT

- A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.
- B. Plywood Subflooring: Either DOC PS 1 or DOC PS 2, Exposure 1, Structural I single-floor panels or sheathing.
DOCUMENT 06 16 00 - SHEATHING

- C. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.
 - 1. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exposure 1 Underlayment with fully sanded face.
 - 2. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch (15.9-mm) nominal thickness.
 - 3. Plywood Underlayment for Carpet: DOC PS 1, Exterior, C-C Plugged.

2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof and wall sheathing, provide fasteners of Type 304 stainless steel.

2.9 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."
- B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.10 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

DOCUMENT 06 16 00 - SHEATHING

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. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- 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 wood framing with nails.
 - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 3. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 - 4. Install panels with a 1/4-inch (6.4-mm) 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.

DOCUMENT 06 16 00 - SHEATHING

2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel 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.

3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION 06 16 00

DOCUMENT 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood roof trusses.
 - 2. Wood floor trusses.
 - 3. Wood girder trusses.

1.2 ALLOWANCES

A. Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Section 012100 "Allowances."

1.3 ACTION SUBMITTALS

- A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
- B. Shop Drawings: Show fabrication and installation details for trusses.
 - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - 2. Indicate sizes, stress grades, and species of lumber.
 - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 6. Show splice details and bearing details.
- C. Delegated-Design Submittals: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For metal-plate-connected wood trusses, signed by officer of trussfabricating firm.

DOCUMENT 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Metal-plate connectors.
 - 2. Metal truss accessories.

1.5 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses are to be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.
- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

DOCUMENT 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (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. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

- A. Fabricate connector plates to comply with TPI 1.
- B. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.

2.4 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 - 2. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Allowable design loads, as published by manufacturer, are to comply with or exceed those of basis-of-design products. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

DOCUMENT 06 17 53 – SHOP-FABRICATED WOOD TRUSSES

2.6 FABRICATION

- A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- F. Securely connect each truss ply required for forming built-up girder trusses.
- G. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 061000 "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- H. Install wood trusses within installation tolerances in TPI 1.
- I. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- J. Replace wood trusses that are damaged or do not comply with requirements.

END OF SECTION 06 17 53

1. GENERAL

1.1. SUMMARY

- A. Section Includes: Light weight composite mineral profile paneling and seam finishing materials to create a monolithic sculptured wall surface.
- B. Products Supplied But Not Installed/Used Under This Section: Installation kit.
- C. Related Requirements:
 - 1. 09 29 00–Gypsum Board: Substrate and seam finishing.
 - 2. 09 91 23–Interior Painting: Sealing and painting of modular screen wall.
 - 3. 26 51 00–Interior Lighting.

1.2. REFERENCES

- A. Abbreviations and Acronyms:
 - 1. ASTM American Society for Testing and Materials.
 - 2. GA Gypsum Association.
- B. Reference Standards:
 - 1. ASTM D 256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
 - 2. ASTM D 696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer.
 - 3. NFPA 286 Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
 - 4. ASTM E 84 Standard Test Methods for Surface Burning Characteristics of Building Materials.
 - 5. GA-214 Recommended Levels of Gypsum Board Finish.

1.3. ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings:
 - 1. Convene meeting at project site within one week of scheduled start of installation with representatives of the following in attendance: Owner, Architect, General Contractor, Installer, Finisher, and Painter.
 - 2. Review substrate conditions, requirements of related work, installation instructions, seam finishing, and painting instructions, storage and handling procedures, and protection measures.
 - 3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and installation instructions.

1.4. ACTION SUBMITTALS

- A. Product Data: Each product specified.
- B. Project List: Minimum 5 previous completed ModularArts, Inc. installations or 5 installations of similar materials and complexity. Include contact name and e-mail address or telephone number for each project.
- C. Shop Drawings: Show standard and project specific details including termination at adjacent surfaces.
- D. Samples: Minimum 15 by 15 inch panel of specified design(s).

1.5. INFORMATIONAL SUBMITTALS

- A. Manufacturer's installation instructions. Regulatory agency sustainability submittals:
- B. Qualification Statements: Proof of manufacturer, installer, and finisher qualifications.

1.7. QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
- B. Qualifications:
 - 1. Manufacturer: Minimum five years' experience in producing mineral profile paneling.
 - 2. Installer: Minimum three years' experience in finish carpentry/architectural woodwork installation.
 - 3. Finisher: Minimum three years' experience in executing Level 5 finish in accordance with GA-214.
- C. Field Samples:
 - 1. Provide in a location selected by Architect showing representative sample of installed product including finished seam.
 - 2. Minimum Size: 8 by 8 feet.
 - 3. Do not proceed with additional work until field sample installation has been approved by Architect.
 - 4. If needed, refinish field sample installation as needed to obtain approval.
 - 5. Approved field samples may remain as part of completed Work.

1.8. DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements:
 - 1. Store panels in fully enclosed environmentally controlled space, protected against damage from moisture, direct sunlight, extreme temperatures, and surface contamination.
 - 2. Store panels vertically, in shipping crates, until ready to be installed. Loosen crate lids to allow for venting. Do not stack or lean against walls.
 - 3. Store panels in area of installation minimum 24 hours prior to installation.

B. Packaging Waste Management: 100 percent of materials used to package components of this section shall be recyclable.

1.9. FIELD CONDITIONS

- A. Ambient Conditions:
 - 1. HVAC: Operate HVAC system to maintain occupancy level temperature and relative humidity conditions (35 to 67 percent) in the area of installation from 24 hours prior to delivery of panels to the installation area through remainder of construction period.
 - 2. Lighting: Permanent project lighting, including any special lighting used to highlight the profiled panels, must be operational prior to seam finishing.

1.10. WARRANTY

A. Manufacturer Warranty: Provide manufacturer's standard limited warranty.

2. PRODUCTS

- 2.1. MANUFACTURER
 - A. Modular Arts, Inc.

CORRESPONDENCE & BILLING ADDRESS: 2400 NW 80th St, #106 Seattle, WA 98117

Tel:	206.788.4210	
	Fax: 206.788.4214	
E-mail:	info@modularArts.com	
Website:	www.modularArts.com	

SHIPPING & RECEIVING ADDRESS: 8207 S 192nd St Kent, WA 98032

B. Substitution Limitations: None permitted.

2.2. COMPONENTS

- A. Profile Panel: Smooth surface mineral composite panel with light weight plant-based foam back.
 - 1. Size: 32 by 32 by 1.5 inch maximum profile relief.
 - 2. Physical Properties:

2	1	
a.	Izod Impact Strength: ASTM D 256	9.4 ft-lb/in ²
b.	Thermal Expansion: ASTM D 696	3.8x10 ⁻⁷ in/in °F.
c.	Compressive Strength: ASTM D 696	2.3 ksi.
d.	Room Corner Burn Test: NFPA 286	Pass
e.	Flame Spread Index: ASTM E 84	0
f.	Smoke Development Index: ASTM E 84	50
g.	Weight (for all designs excluding MUDD formerly YUMA)	1.5 psf
h.	Weight (for MUDD design only)	3 psf

- 3. Design: Ansel & Ventanas (Horizontal) & Woodypeck (Vertical) ©; orientation. Note: Modular Arts designs are protected by registered copyrights and may not be duplicated. Attempts to copy or closely mimic Modular Arts original designs will be considered a violation of intellectual property rights and will be duly pursued.
- B. Installation Kit: Item quantities in parenthesis denote quantities for (Small Kit—up to 50 panels/Large Kit—up to 100 panels). (Not applicable to *EZ-SeamTM* Designs.)
 - 1. Dry Mix Joint Compound: One 18 lb. bag SHEETROCK® brand EASY SAND[™] 45, or BEADEX® brand SILVER SET[™] 40.
 - 2. Acrylic Fortifier: (One/Two) quart MasterEmaco® A 660.
 - 3. Construction Adhesive: (12/24) 10.2 oz tubes PL® Polyurethane Premium Construction Adhesive.
 - 4. Countersink Drill Bit with Depth Stop-Collar: (One/Two) No. 7.
 - 5. Flexible Spreader: (One/Two) MUDTOOLS SMT-Y2
 - 6. Sandpaper: (15/30) sheets No-Load 220G, (10/20) sheets No-Load 150G.
 - 7. Plastic Container: One 100 oz.
 - 8. Measuring Cup: One 8 oz.

2.3. ACCESSORIES

- A. Anchors: 30 lb. self-drilling, drywall anchor.
- B. Screws: Coarse thread, drywall type, length as required by panel design and in accordance with Manufacturer's Installation Instructions.

2.4. SOURCE QUALITY CONTROL

Fabrication Tolerances:				
1.	Dimensions, length and width:	$\pm 1/16$ inch.		
2.	Thickness:	$\pm 1/16$ inch.		
3.	Weight:	$\pm 1/2$ lb.		

3. EXECUTION

A.

3.1. EXAMINATION

- A. Examine substrates upon which profile paneling will be installed.
 - 1. Verify that substrate is a material listed as an acceptable substrate by the profile paneling manufacturer.
- B. Verify that permanent project lighting is in place and operational prior to start of seam finishing.
- C. Coordinate with responsible entity to correct unsatisfactory conditions.
- D. Commencement of work by installer is acceptance of substrate conditions.

3.2. INSTALLATION

Author File Name

A. Install profile paneling in accordance with Manufacturer's Installation Instructions except that seam finishing shall be performed under Section 09 29 00–Gypsum Board. Sealing and painting shall be performed under Section 09 91 23–Interior Painting.

3.3. CLEANING

A. Waste Management: Refer to Section 01 74 00 \Box Cleaning and Waste Management.

3.4. PROTECTION

A. Protect finished work from damage during remainder of construction period.

END OF SECTION 06 26 14

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-clad architectural cabinets.
 - 2. Cabinet hardware and accessories.
 - 3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Research reports.
- C. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

1.7 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET MANUFACTURERS

2.2 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
- B. Architectural Woodwork Standards Grade: Premium.
- C. Type of Construction: Face frame.
- D. Door and Drawer-Front Style: Reveal overlay.
 - 1. Reveal Dimension: 1/2 inch (13 mm).
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

- 1. <u>Manufacturers:</u> 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. <u>ABET Inc</u>.
 - b. Formica Corporation.
 - c. <u>Laminart LLC</u>.
 - d. <u>Pionite; a Panolam Industries International, Inc. brand</u>.
 - e. <u>Wilsonart LLC</u>.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: Grade HGS
 - 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- 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.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 8 to 13 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
 - 2. Particleboard (Medium Density): ANSI A208.1, Grade M-2.
 - 3. Softwood Plywood: DOC PS 1, medium-density overlay.

4. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF 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.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
 - 1. Semiconcealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.
 - 2. Semiconcealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
- E. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.
- F. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.
- G. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.
- H. Drawer Slides: ANSI/BHMA A156.9.
 - 1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.
 - a. Type: Full extension.
 - b. Material: Stainless steel slides.
 - c. Motion Feature: Soft close dampener.
- I. Slides for Sliding Glass Doors: ANSI/BHMA A156.9, B07063; aluminum.
- J. Door Locks: ANSI/BHMA A156.11, E07121.
- K. Drawer Locks: ANSI/BHMA A156.11, E07041.
- L. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- M. Float Glass for Cabinet Doors: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
 - 1. Thickness: 4.0 mm.

- N. Grommets for Cable Passage: 1-1/4-inch (32-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Color: Black.
- O. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 1. Satin Stainless Steel: ANSI/BHMA 630.
- P. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 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 nonferrousmetal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 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.
- C. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual."
 - 1. For glass in frames, secure glass with removable stops.
 - 2. For exposed glass edges, polish and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings 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.
 - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish] [toggle bolts through metal backing or metal framing behind wall finish.

3.2 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 - 1. Inspection entity shall prepare and submit report of inspection.

END OF SECTION 06 41 16

DOCUMENT 07 14 16 – COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:1. Cold-applied rubberized asphalt waterproofing.

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:
 - 1. Show locations and extent of waterproofing.
 - 2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.6 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

DOCUMENT 07 14 16 - COLD FLUID-APPLIED WATERPROOFING

PART 2 - PRODUCTS

2.1 COLD-APPLIED RUBBERIZED ASPHALT WATERPROOFING

- A. Single-Component, Rubberized Asphalt Waterproofing: Single-component, silyl-terminated polyether complying with ASTM C836/C836M.
 - 1. <u>Manufacturers:</u> 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. Barrett Company.
 - b. <u>Henry Company</u>.
 - c. <u>W. R. Meadows, Inc</u>.
 - 2. Elongation at Break: 360 percent minimum; ASTM D412.
 - 3. Water Vapor Permeance: 0.03 perm (1.72 ng/Pa x s x sq. m), maximum, ASTM E96/E96M.
 - 4. Hydrostatic-Head Resistance: **100 psi (690 kPa)** average; ASTM D5385/D5385M.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.
- F. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

DOCUMENT 07 14 16 – COLD FLUID-APPLIED WATERPROOFING

G. Prepare, treat, rout, and fill joints and cracks in substrate in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C1471/C1471M. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D4258.

3.2 INSTALLATION OF WATERPROOFING

- A. Apply waterproofing in accordance with manufacturer's written instructions and to recommendations in ASTM C1471/C1471M.
- B. Unreinforced Waterproofing Applications.
 - 1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of **90 mils** (**2.25 mm**).
- C. Reinforced Waterproofing Applications.
 - 1. Apply first coat of waterproofing, embed membrane-reinforcing fabric, and apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases and pinholes, with an average dry film total thickness of **80 mils (2 mm)**.
- D. Protect waterproofing from damage and wear during remainder of construction period.
- E. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION 07 14 16

DOCUMENT 07 19 00 – WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:
 - 1. Cast-in-place concrete.
 - 2. Cast stone.
 - 3. Concrete unit masonry.
 - 4. Clay brick masonry.

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 type of water repellent and substrate indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

A. Silane, Penetrating Water Repellent: Clear, containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.

DOCUMENT 07 19 00 – WATER REPELLENTS

- 1. <u>Manufacturers:</u> 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. <u>Advanced Chemical Technologies, Inc</u>.
 - b. <u>PROSOCO, Inc</u>.
 - c. <u>Pecora Corporation</u>.
 - d. <u>W. R. Meadows, Inc</u>.

PART 3 - EXECUTION

3.1 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. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 - 3. 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.

3.2 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.
- B. 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
- C. 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.
- D. 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.

DOCUMENT 07 19 00 – WATER REPELLENTS

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.

3.3 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 coating of water repellent on surfaces to be treated using low-pressure spray to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
 - 1. Cast Stone: At Contractor's option, first application of water repellent may be completed before installing units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces. Remove masking after repellent has cured.
- 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.

3.4 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 07 19 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Glass-fiber blanket insulation.

1.3 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
 - 1. Sign, date, and post the certification in a conspicuous location on Project site.
- B. Product test reports.
- C. Research reports.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type X: ASTM C578, Type X, 15-psi (104-kPa) minimum compressive strength; unfaced.
 - 1. <u>Manufacturers:</u> 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. <u>DiversiFoam Products</u>.
 - b. <u>DuPont de Nemours, Inc</u>.

- c. <u>MBCI; Cornerstone Building Brands</u>.
- d. <u>Owens Corning</u>.
- e. <u>The Dow Chemical Company</u>.
- 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
- 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
- 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
- 6.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
 - 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. <u>Knauf Insulation</u>.
 - d. <u>Owens Corning</u>.
 - 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
- B. Glass-Fiber Blanket Insulation, Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
 - 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. <u>Knauf Insulation</u>.
 - d. <u>Owens Corning</u>.
 - 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.3 GLASS-FIBER BOARD INSULATION

- A. Glass-Fiber Board Insulation, Faced: ASTM C612, Type IA; faced on one side with foil-scrimkraft or foil-scrim-polyethylene vapor retarder.
 - 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. <u>Knauf Insulation</u>.
 - d. Owens Corning.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 - 4. Nominal Density: **3 lb/cu. ft. (48 kg/cu. m)**.
 - 5. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C).
 - 6. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsolled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer.
 - 1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.
 - 3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

- 4. Attics: 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 (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- 6. For wood-framed construction, install blankets according to ASTM C1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- 7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward exterior of construction.
 - b. Interior Walls: Set units with facing placed as indicated on Drawings.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
 - 1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
 - 2. Install insulation to fit snugly without bowing.

END OF SECTION 07 21 00

DOCUMENT 07 26 00 – VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforced-polyethylene vapor retarders.
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 REINFORCED-POLYETHYLENE VAPOR RETARDERS

- A. Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 20 lb/1000 sq. ft. (9 kg/100 sq. m), with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).
 - 1. <u>Manufacturers:</u> 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. <u>ISI Building Products</u>.
 - b. <u>Raven Industries, Inc</u>.
 - c. <u>Reef Industries, Inc</u>.
 - d. <u>W. R. Meadows, Inc</u>.

DOCUMENT 07 26 00 – VAPOR RETARDERS

PART 3 - EXECUTION

3.1 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS IN CRAWL SPACES

- A. Install vapor retarders over prepared grade. Lap joints a minimum of 12 inches (305 mm) and seal with manufacturer's recommended tape. Install second layer over pathways to equipment.
- B. Extend vapor retarder over footings and seal to foundation wall or grade beam with manufacturer's recommended tape.
 - 1. Extend vapor retarder vertically minimum 24 inches (610 mm) above top of footing.
- C. Seal around penetrations such as utilities and columns in order to create a monolithic, airtight membrane at grade surface, perimeter, and all vertical penetrations.

END OF SECTION 07 26 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber-reinforced asphalt shingles.
 - 2. Underlayment materials.
 - 3. Ridge vents.
 - 4. Metal flashing and trim.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Asphalt shingles.
 - 2. Underlayment materials.
 - 3. Ridge vents.
 - 4. Asphalt roofing cement.
 - 5. Elastomeric flashing sealant.
- B. Shop Drawings: For metal flashing and trim.
- C. Samples: For each exposed product and for each color and blend specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research reports for synthetic underlayment.
- C. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- 1.6 QUALITY ASSURANCE
 - A. Installer Qualifications: An authorized installer who is trained and approved by manufacturer.

1.7 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
 - 1. Materials Warranty Period: 25 years from date of Substantial Completion, prorated, with first five years nonprorated.
 - 2. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to 110 mph (49 m/s) for 15 years from date of Substantial Completion.
 - 3. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for 25 years from date of Substantial Completion.
 - 4. Workmanship Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Wind Resistance: Provide asphalt shingles that comply with requirements of ASTM D3161/D3161M, Class F, and with ASTM D7158/D7158M, Class H.
- C. Energy Performance, ENERGY STAR: Provide asphalt shingles that are listed on the DOE's "ENERGY STAR Roof Product List" for steep-slope roof products.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Impact-Resistant, Three-Tab-Strip Asphalt Shingles: ASTM D3462/D3462M; glass-fiber reinforced, mineral-granule surfaced, and self-sealing; with tabs regularly spaced and with impact resistance complying with UL 2218, Class 4.
 - 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - 2. Strip Size: Manufacturer's standard.
 - 3. Algae Resistance: Granules resist algae discoloration.
 - 4. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

2.3 UNDERLAYMENT MATERIALS

- A. Organic Felt: Asphalt-saturated organic felts, nonperforated and complying with the following:
- B. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum 50-mil-(1.3-mm-) thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied.
 - 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - b. <u>GAF</u>.
 - c. <u>Owens Corning</u>.
 - d. <u>Tamko Building Products LLC</u>.
 - 2. Top Surface: Polyester.

2.4 RIDGE VENTS

A. Rigid Ridge Vent: Manufacturer's standard, rigid-section, high-density, UV-stabilized plastic ridge vent for use under ridge shingles.

- 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - b. <u>GAF</u>.
 - c. <u>Owens Corning</u>.
 - d. <u>Tamko Building Products LLC</u>.
 - e. Nonwoven geotextile filter strips.
 - f. External deflector baffles.

2.5 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.
- B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.
- C. Roofing Nails: ASTM F1667, aluminum, stainless steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, sharp-pointed, with a 3/8- to 7/16-inch- (10- to 11-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through sheathing less than 3/4 inch (19 mm) thick.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- D. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, 1-inch- (25-mm-) minimum diameter.
 - 1. Provide with minimum 0.0134-inch- (0.34-mm-) thick metal cap, 0.010-inch- (0.25-mm-) thick power-driven metal cap, or 0.035-inch- (0.89-mm-) thick plastic cap; and with minimum 0.083-inch- (2.11-mm-) thick ring shank or 0.091-inch- (2.31-mm-) thick smooth shank of length to penetrate at least 3/4 inch (19 mm) into roof sheathing or to penetrate through roof sheathing less than 3/4 inch (19 mm) thick.

2.6 METAL FLASHING AND TRIM

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Sheet Metal: Zinc-tin alloy coated copper.

ASPHALT SHINGLES

- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item unless otherwise indicated on Drawings.
 - 1. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches (102 mm) from pipe onto roof.

PART 3 - EXECUTION

3.1 INSTALLATION OF UNDERLAYMENT MATERIALS

- A. Comply with asphalt shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.
- B. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck in locations indicated on Drawings.
 - 1. Comply with low-temperature installation restrictions of underlayment manufacturer.
 - 2. Install lapped in direction that sheds water.
 - a. Lap sides not less than 4 inches (102 mm).
 - b. Lap ends not less than 6 inches (152 mm), staggered 24 inches (610 mm) between succeeding courses.
 - c. Roll laps with roller.
 - 3. Prime concrete, masonry, and metal surfaces to receive self-adhering sheet.
 - 4. Cover underlayment within seven days.
- C. Metal-Flashed, Open-Valley Underlayment: Install two layers of minimum 36-inch- (914-mm-) wide underlayment centered in valley.
 - 1. Use same underlayment as installed on field of roof.
 - 2. Stagger end laps between layers at least 72 inches (1829 mm).
 - 3. Lap ends of each layer at least 12 inches (305 mm) in direction that sheds water, and seal with asphalt roofing cement.
 - 4. Fasten each layer to roof deck with underlayment nails located as far from valley center as possible and only to extent necessary to hold underlayment in place until installation of valley flashing.
 - 5. Lap roof-deck underlayment over first layer of valley underlayment at least 6 inches (152 mm).
DOCUMENT 07 31 13 – ASPHALT SHINGLES

3.2 INSTALLATION OF METAL FLASHING AND TRIM

- A. Install metal flashings and trim to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Bed flanges of metal flashings using asphalt roofing cement or elastomeric flashing sealant.
- B. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.3 INSTALLATION OF ASPHALT SHINGLES

- A. Install asphalt shingles in accordance with manufacturer's written instructions and recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 3/4 inch (19 mm) over fasciae at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of three-tab-strip asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of six roofing nails, but not less than the number indicated in manufacturer's written instructions for roof slope and design wind speed indicated on Drawings and for warranty requirements specified in this Section.
 - 1. Locate fasteners in accordance with manufacturer's written instructions.
 - 2. Where roof slope is less than 4:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
 - 3. When ambient temperature during installation is below 50 deg F (10 deg C), hand seal self-sealing asphalt shingles by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
- E. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches (305 mm) beyond center of valley.
 - 1. Use one-piece shingle strips without joints in valley.
 - 2. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches (51 mm) short of valley centerline.
 - 3. Trim upper concealed corners of cut-back shingle strips.

DOCUMENT 07 31 13 - ASPHALT SHINGLES

- 4.
- Do not nail asphalt shingles within 6 inches (152 mm) of valley center. Set trimmed, concealed-corner asphalt shingles in a 3-inch- (76-mm-) wide bed of asphalt 5. roofing cement.

END OF SECTION 07 31 13

DOCUMENT 07 42 93 – SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal soffit panels.
- 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: Two years from date of Substantial Completion.

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DOCUMENT 07 42 93 – SOFFIT PANELS

- 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 the following loads, based on testing according to ASTM E 1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: **1.57 lbf/sq. ft. (75 Pa)**.
- 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: 2.86 lbf/sq. ft. (137 Pa).
- 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. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METAL SOFFIT PANELS

- 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 in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels:

DOCUMENT 07 42 93 – SOFFIT PANELS

- 1. Finish: As indicated on Drawings.
- 2. Sealant: Factory applied within interlocking joint.
- C. Flush-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.
 - 1. <u>Manufacturers:</u> 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. <u>AEP Span; A BlueScope Steel Company</u>.
 - b. Architectural Building Components.
 - c. <u>Berridge Manufacturing Company</u>.
 - d. <u>Dimensional Metals, Inc</u>.
 - e. <u>Drexel Metals</u>.
 - f. <u>Englert, Inc</u>.
 - g. <u>Fabral</u>.
 - h. <u>MBCI</u>.
 - 2. Material: Same material, finish, and color as metal fascia.
 - 3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.028 inch (0.71 mm).
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 4. Panel Coverage: 24 inches wide.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) 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.

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DOCUMENT 07 42 93 – SOFFIT PANELS

- 1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) 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 Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant types recommended by manufacturer 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 (3 mm) 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. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. 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.
- E. 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.

DOCUMENT 07 42 93 – SOFFIT PANELS

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. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 - 3. 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: Wire tie or 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. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - 4. 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:

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DOCUMENT 07 42 93 – SOFFIT PANELS

- 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 (152-mm) 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 07 42 93

DOCUMENT 07 62 00 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manufactured reglets with counterflashing.
 - 2. Formed roof-drainage sheet metal fabrications.
 - 3. Formed steep-slope roof sheet metal fabrications.
 - 4. 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.

DOCUMENT 07 62 00 – SHEET METAL FLASHING AND TRIM

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.

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 copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: 110 mph.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

DOCUMENT 07 62 00 - SHEET METAL FLASHING AND TRIM

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), 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 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - a. Color: As selected by Architect from manufacturer's full range.
- C. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. <u>Manufacturers:</u> 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. <u>Carlisle WIP Products; a brand of Carlisle Construction Materials</u>.
 - b. <u>Drexel Metals</u>.
 - c. <u>GCP Applied Technologies Inc</u>.
 - d. <u>Henry Company</u>.
 - e. <u>Owens Corning</u>.
 - f. <u>SDP Advanced Polymer Products Inc</u>.
 - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
 - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.
- D. Slip Sheet: Rosin-sized building paper, <u>3 lb/100 sq. ft</u>. (0.16 kg/sq. m)minimum.

2.3 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.

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- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
 - 3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 5. Fasteners for Zinc-Coated (Galvanized) 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 Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 - 2. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 3. 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.
- 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 (13 mm) wide and 1/8 inch (3 mm) 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.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

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I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 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 factorymitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
 - 1. <u>Manufacturers:</u> 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. <u>Fry Reglet Corporation</u>.
 - b. <u>Heckmann Building Products, Inc</u>.
 - c. <u>Keystone Flashing Company, Inc</u>.
 - d. <u>OMG, Inc</u>.
 - 2. Material: Galvanized steel, 0.022 inch (0.56 mm) thick.
 - 3. Finish: With manufacturer's standard color coating.

2.5 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 (25 mm) 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.

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- 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.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
 - 1. Accessories: Valley baffles.
- B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
 - 1. Fabricate from the following materials:
 - a. Galvanized Steel: **0.022 inch** (**0.56 mm**) thick.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.022 inch (0.56 mm) thick.
- B. Valley Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
- C. Drip Edges: Fabricate from the following materials:
 1. Galvanized Steel: 0.022 inch (0.56 mm) thick.
- D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
 1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

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2.8 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings; and form with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
 - 1. Copper: **16 oz./sq. ft.** (**0.55 mm thick**).
- B. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
 - 1. Copper: **16 oz./sq. ft. (0.55 mm thick)**.
- C. Wall Expansion-Joint Cover: Fabricate from the following materials:
 1. Aluminum: 0.040 inch (1.02 mm) thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective

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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 (300 mm) 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 pressuretreated 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 (3 m)** with no joints within **24 inches (600 mm)** of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) 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 (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.

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- 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.

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or[joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet (15.24 m) apart. Install expansion-joint caps.
 - 2. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
- D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches (100 mm) in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and 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.

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- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm).
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 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. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry."
- C. Reglets: Installation of reglets is specified in Section 042000 "Unit Masonry." Opening
- D. Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- 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.

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END OF SECTION 07 62 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Silicone joint sealants.
- 2. Nonstaining silicone joint sealants.
- 3. Urethane joint sealants.
- 4. Immersible joint sealants.
- 5. Mildew-resistant joint sealants.
- 6. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product data.
- B. Samples: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-sealant schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Field Quality-Control Submittals:
 - 1. Field-Adhesion-Test Reports: For each sealant application tested.
- B. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 - 1. Manufacturers' special warranties.

JOINT SEALANTS

2. Installer's special warranties.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installers: Authorized representative who is trained and approved by manufacturer.
 - 2. Testing Agency: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. <u>Manufacturers:</u> 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. <u>Adfast</u>.
 - b. <u>GE Construction Sealants; Momentive Performance Materials Inc</u>.
 - c. Sika Corporation Building Components.

2.3 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - 1. <u>Manufacturers:</u> 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. <u>Adfast</u>.
 - b. <u>Alcot Plastics Ltd</u>.
 - c. <u>Construction Foam Products; a division of Nomaco, Inc</u>.
 - d. <u>Master Builders Solutions</u>.
- B. Cylindrical Sealant Backings: ASTM C1330, Type B (bicellular material with a surface skin) 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.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.

- c. Porcelain enamel.
- d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants 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 in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. 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.
- H. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - a. Extent of Testing: Test completed and cured sealant joints as follows:
 - 1) Perform 10 tests for the first 1000 ft. (300 m) of joint length for each kind of sealant and joint substrate.
 - 2) Perform one test for each 1000 ft. (300 m) of joint length thereafter or one test per each floor per elevation.
 - b. Test Method: Test joint sealants in accordance with Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

- c. Inspect tested joints and report on the following:
 - 1) Whether sealants filled joint cavities and are free of voids.
 - 2) Whether sealant dimensions and configurations comply with specified requirements.
 - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
- d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
- e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- 2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- C. Prepare test and inspection reports.

3.4 JOINT-SEALANT SCHEDULE

- A. Exterior joints in horizontal traffic surfaces:
 - 1. Joint Locations:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Joints between plant-precast architectural concrete paving units.
 - d. Joints in stone paving units, including steps.
 - e. Tile control and expansion joints.
 - f. Joints between different materials listed above.
 - g. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, M, P, 50, T, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- B. Exterior joints in horizontal traffic surfaces subject to water immersion:
 - 1. Joint Locations:
 - a. Joints in pedestrian plazas.
 - b. Joints in swimming pool decks.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, immersible, S, P, 25, T, NT, I.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Exterior joints in vertical surfaces and horizontal nontraffic surfaces[JS-#]:
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in dimension stone cladding.
 - e. Joints in glass unit masonry assemblies.
 - f. Joints in exterior insulation and finish systems.
 - g. Joints between metal panels.
 - h. Joints between different materials listed above.
 - i. Perimeter joints between materials listed above and frames of doors, windows and louvers.
 - j. Control and expansion joints in ceilings and other overhead surfaces.
 - k. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Interior joints in horizontal traffic surfaces:
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in stone flooring.
 - c. Control and expansion joints in brick flooring.
 - d. Control and expansion joints in tile flooring.
 - e. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, S, P, 25, T, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Interior joints in vertical surfaces and horizontal nontraffic surfaces:

- 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry walls and partitions.
 - d. Joints on underside of plant-precast structural concrete beams and planks.
 - e. Other joints as indicated on Drawings.
- 2. Joint Sealant: Urethane, S, NS, 25, NT.
- 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement:
 - 1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces:
 - 1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- H. Concealed mastics:
 - 1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Butyl-rubber based.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Hollow-core flush wood veneer-faced doors for transparent finish.
- 2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
 - 1. Door core materials and construction.
 - 2. Door edge construction
 - 3. Door face type and characteristics.
 - 4. Door louvers.
 - 5. Door trim for openings.
 - 6. Factory-machining criteria.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 - 1. Door schedule indicating door location, type, size, fire protection rating, and swing.
 - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 - 3. Dimensions and locations of blocking for hardware attachment.
 - 4. Clearances and undercuts.
 - 5. Requirements for veneer matching.
 - 6. Apply AWI Quality Certification Program label to Shop Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.4 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
- 2.2 FLUSH WOOD DOORS, GENERAL
 - A. Quality Standard: In addition to requirements specified, comply with "Architectural Woodwork Standards."
 - 1. Provide certificates from AWI certification program indicating that doors comply with requirements of grades specified.
 - a. This project has been registered with AWI as AWI Quality Certification Program Number.
 - b. Contractor registers the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.

2.3 HOLLOW-CORE FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Doors, Hollow-Core Veneer-Faced:
 - 1. <u>Manufacturers:</u> 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. <u>ABS- American Building Supply- Doormerica</u>.
 - b. <u>Chappell Door Co</u>.
 - c. <u>General Veneer Manufacturing Co</u>.
 - d. <u>Haley Brothers, Inc</u>.
 - e. <u>Lambton Doors</u>.
 - f. Lynden Door, Inc.
 - g. <u>Vancouver Door Company</u>.
 - 2. Performance Grade: ANSI/WDMA I.S. 1A Standard Duty.
 - 3. Architectural Woodwork Standards Grade: Custom.
 - 4. Species: Select white birch.

- 5. Cut: Rotary cut.
- 6. Match between Veneer Leaves: Book match.
- 7. Assembly of Veneer Leaves on Door Faces: Balance match.
- 8. Pair and Set Match: Provide for doors hung in same opening.
- 9. Exposed Vertical and Top Edges: Same species as faces or a compatible species Architectural Woodwork Standards edge Type A.
- 10. Construction: Institutional hollow core.
- 11. Blocking: Provide wood blocking with minimum dimensions as follows:
 - a. 5-by-18-inch (125-by-460-mm) lock blocks.
 - b. 2-1/2-inch (64-mm) midrail blocking.

2.4 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Species compatible with door faces.
 - 2. Profile: Manufacturer's standard shape.
 - 3. Wood Species: Species compatible with door faces.
 - 4. Profile: Flat.
- B. Metal Louvers:
 - 1. <u>Manufacturers:</u> 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. <u>ASSA ABLOY</u>.
 - b. <u>Allegion plc</u>.
 - c. <u>Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc</u>.
 - d. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - e. <u>L & L Louvers, Inc</u>.
 - f. <u>McGill Architectural Products</u>.
 - 2. Blade Type: Vision-proof, inverted V.
 - 3. Metal and Finish:
 - a. Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied.
 - 1. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 - 2. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 - 3. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 - 4. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. 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."
 - 3. Louvers: Factory install louvers in prepared openings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Job-Fitted Doors:
 - 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
 - 2. Machine doors for hardware.
 - 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 4. Clearances:

- a. Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors.
- b. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
- c. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
- 5. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.

3.2 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Provide inspection of installed Work through AWI's Quality Certification Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
 - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

DOCUMENT 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Access doors and frames.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of access door and frame and for each finish specified.
- C. Product Schedule: For access doors and frames.

1.3 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.4 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of firerated door assemblies meets the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

DOCUMENT 08 31 13 - ACCESS DOORS AND FRAMES

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges:
 - 1. <u>Manufacturers:</u> 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. <u>Cendrex Inc</u>.
 - b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - c. <u>Larsen's Manufacturing Company</u>.
 - 2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 - 3. Optional Features: Masonry anchors.
 - 4. Locations: Wall and ceiling.
 - 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
 - 6. Latch and Lock: Cam latch, screwdriver operated.

2.3 MATERIALS

- A. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- B. Frame Anchors: Same material as door face.
- C. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

- A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- C. Latch and Lock Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.
DOCUMENT 08 31 13 - ACCESS DOORS AND FRAMES

3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."

2.5 FINISHES

- A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Adjust doors and hardware, after installation, for proper operation.

3.2 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80.

END OF SECTION 08 31 13

DOCUMENT 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glazed aluminum curtain wall systems.

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 type of exposed finish required.
- D. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- B. Product test reports.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Sample warranties.

DOCUMENT 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS

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 and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors Retain "Testing Agency Qualifications" Paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
- 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 Assembly Warranty: Installer agrees to repair or replace components of glazed aluminum curtain wall 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, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

DOCUMENT 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 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.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans of greater than 13 feet 6 inches (4.1 m).
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).
 - a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.
 - 3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.

DOCUMENT 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS

- E. Structural: Test in accordance with ASTM E330/E330M 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.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa)] [15 lbf/sq. ft. (720 Pa).
- G. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.38 Btu/sq. ft. x h x deg F (2.16 W/sq. m x K) as determined in accordance with NFRC 100.
 - 2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.45 as determined in accordance with NFRC 200.
 - 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than **0.06 cfm/sq. ft.** (**0.30 L/s per sq. m**) at a static-air-pressure differential of **1.57 lbf/sq. ft.** (**75 Pa**) when tested in accordance with ASTM E283.
 - 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.
- H. Windborne-Debris Impact Resistance: Pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.
 - 1. Large-Missile Test: For glazing located within **30 feet (9.1 m)** of grade.

DOCUMENT 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS

- 2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and 60 feet (18.2 m) above grade.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

- A. <u>Manufacturers:</u> 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. <u>EFCO Corporation</u>.
 - 2. <u>HMI</u>.
 - 3. <u>Kawneer Company, Inc.; Arconic Corporation</u>.
 - 4. Oldcastle BuildingEnvelope (OBE); CRH Americas, Inc.
- B. 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. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Front.
 - 4. Finish: Color anodic finish.
 - 5. System: Either stick or unitized system.
 - 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 7. Steel Reinforcement: As required by manufacturer.
- C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 - 1. Include snap-on aluminum trim that conceals fasteners.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard.

GLAZED ALUMINUM CURTAIN WALLS

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- 1. Color: Black.
- C. Glazing Sealants: As recommended by manufacturer.

2.4 MATERIALS

- A. Sheet and Plate: ASTM B209 (ASTM B209M).
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: 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 in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.5 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints 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 exterior.
- C. Fabricate components to resist water penetration as follows:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

DOCUMENT 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS

- 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- D. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method. Retain "Factory-Assembled Frame Units" Paragraph below for unitized system. Revise to suit Project.
- E. Factory-Assembled Frame Units:
 - 1. Rigidly secure nonmovement joints.
 - 2. Prepare surfaces that are in contact with structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion.
 - 3. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 4. Seal joints watertight unless otherwise indicated.
 - 5. Install glazing to comply with requirements in Section 088000 "Glazing."
- F. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.6 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
 - A. Comply with manufacturer's written instructions.
 - B. Do not install damaged components.
 - C. Fit joints to produce hairline joints free of burrs and distortion.
 - D. Rigidly secure nonmovement joints.
 - E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

DOCUMENT 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS

- F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- G. Seal joints watertight unless otherwise indicated.
- H. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
- J. Install components plumb and true in alignment with established lines and grades.

3.2 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.
- C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
- D. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

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END OF SECTION 08 44 13

DOCUMENT 08 52 00 – WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal-clad wood windows.

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, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranties.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 10 years from date of Substantial Completion.
 - c. Vinyl Cladding: Lifetime warranty.

DOCUMENT 08 52 00 – WOOD WINDOWS

PART 2 - PRODUCTS

2.1 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: WDMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: LC.
 - 2. Minimum Performance Grade: 35.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K).
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.

2.2 WOOD WINDOWS

- A. Metal-Clad Wood Windows:
 - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Pella Wood Windows; Fixed Frame Direct Set.
- B. Operating Types: Fixed.
- C. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.
 - 1. Exterior Finish: Metal-clad wood.
 - a. Exposed Unfinished Wood Surfaces: Manufacturer's standard paint-grade species.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 2. Interior Finish: Manufacturer's standard stain-and-varnish finish.
 - a. Exposed Unfinished Wood Surfaces: Manufacturer's standard species.

DOCUMENT 08 52 00 - WOOD WINDOWS

- b. Color: As selected by Architect from manufacturer's full range.
- D. Insulating-Glass Units: ASTM E 2190.
 - 1. Glass: ASTM C 1036, Type 1, Class 1, q3.
 - a. Tint: Clear.
 - b. Kind: Fully tempered where indicated on Drawings.
 - 2. Lites: As indicated on drawings.
 - 3. Filling: Fill space between glass lites with argon.
 - 4. Low-E Coating: Pyrolytic on second surface.
- E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- F. Hardware, General: Provide manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

- A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze wood windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

DOCUMENT 08 52 00 – WOOD WINDOWS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- D. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
- E. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 52 00

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC International Building Code.
 - 3. NFPA 70 National Electrical Code.
 - 4. NFPA 80 Fire Doors and Windows.
 - 5. NFPA 101 Life Safety Code.
 - 6. NFPA 105 Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.

- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards A156 Series.
 - 2. UL10C Positive Pressure Fire Tests of Door Assemblies.
 - 3. ANSI/UL 294 Access Control System Units.
 - 4. UL 305 Panic Hardware.
 - 5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data,

Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

- 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Five years for standard duty cylindrical (bored) locks and latches.
 - 3. Ten years for manual overhead door closer bodies.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.

- b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
- 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
- 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
- 5. Manufacturers:
 - a. Hager Companies (HA).
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
 - c. Stanley Hardware (ST).
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cutouts.
 - 1. Manufacturers:
 - a. Pemko (PE).

2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 5. Manufacturers:
 - a. Door Controls International (DC).

- b. Rockwood (RO).
- c. Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 5. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood (RO).
 - c. Trimco (TC).

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - 4. Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 6. Keyway: Manufacturer's Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.

- 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
- 3. New System: Key locks to a new key system as directed by the Owner.
- E. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.5 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
 - 1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).
- P. Electronic Key Management System: Provide an electronic key control system with Stand-alone Plug and Play features including advanced RFID technology. Touchscreen interface with PIN access for keys individually locked in place. Minimum 1,000 system users and 21 iFobs for locking receptors. System shall have a minimum 250,000 audit events screen displayed or ability to be exported via USB port.
 - 1. Manufacturers:
 - a. Medeco (MC).
 - b. Traka (TA).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) ML2000 Series.
 - b. Sargent Manufacturing (SA) 8200 Series.
 - c. Yale Commercial(YA) 8800FL Series.
- B. Cylindrical Locksets, Grade 2 (Standard Duty): ANSI/BHMA A156.2, Series 4000, Grade 2 Certified Products Directory (CPD) listed.
 - 1. Locks are to be non-handed and fully field reversible.
 - 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) CL3800 Series.
 - b. Sargent Manufacturing (SA) 7 Line.
 - c. Yale Commercial(YA) 5300LN Series.

2.7 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 - 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 - 5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 - 6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 - 7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 - 8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 - 9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 - 10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Commercial Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the

functions specified in the Hardware Sets. Fabricate latchbolts from cast stainless steel, Pullman type, incorporating a deadlocking feature.

- 1. Manufacturers:
 - a. Yale Commercial(YA) 6000 Series.

2.9 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
 - 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 - 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 - 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 - 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Standard Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) DC3000 Series.
 - b. Sargent Manufacturing (SA) 1331 Series.
 - c. Yale Commercial(YA) 2700 Series.
 - d. Norton Rixson (NO) 210 Series

2.10 ARCHITECTURAL TRIM

- A. Door Protective Trim
 - 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
 - 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
 - 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
 - 4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
 - 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
 - 6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood (RO).
 - c. Trimco (TC).

2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 - 1. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood (RO).

c. Trimco (TC).

2.12 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. National Guard Products (NG).
 - 2. Pemko (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.13 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.14 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

- 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
- 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
- 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

Hardware Sets

Set: 1.0 Doors: 1, 11 Description: EXT - PR - ALUM

2	Continuous Hinge	CFMXXHD1		PE
1	Surface Vert Rod Exit, Exit Only	6170 EO	630	YA
1	Surface Vert Rod Exit, Nightlatch	6170 121NL	630	YA

 Door Pull [Offset] Surface Closer/Stop Door Stop Threshold Gasketing 	RM3310-24 2731 467 271A MSES25SS by door / frame mfg	US32D 689 Black	RO YA RO PE
<u>Set: 2.0</u> Doors: 13, 26 Description: EXT - SGL - PANIC			
 3 Hinge, Full Mortise, Hvy Wt 1 Rim Exit Device, Classroom 1 Surface Closer/Stop 1 Door Stop 1 Threshold 1 Gasketing 1 Rain Guard 1 Sweep 	MPB68 4-1/2" x 4-1/2" 6100ED AU626F 2731 467 271A MSES25SS 303AS 346C x LAR 3452AV	US26D 630 689 Black	MK YA YA RO PE PE PE PE
<u>Set: 3.0</u> Doors: 34 Description: EXT - EXIT - EO			
 Continuous Hinge Rim Exit Device, Exit Only Surface Closer/Stop Kick Plate Threshold Gasketing Rain Guard Sweep 	CFMXXHD1 6100 EO 2721 K1050 10" X 2" LDW 271A MSES25SS 303AS 346C x LAR 3452AV	630 689 US32D	PE YA YA RO PE PE PE PE
<u>Set: 4.0</u> Doors: 16 Description: EXT - CLASS			
 3 Hinge, Full Mortise, Hvy Wt 1 Classroom Lock 1 Surface Closer/Stop 1 Threshold (Heavy Duty) 1 Gasketing 1 Rain Guard 1 Sweep 	MPB68 4-1/2" x 4-1/2" AU 4608LN 2721 2715AK MSES25SS S88D 346C x LAR 3452AV	US26D 626 689	MK YA YA PE PE PE PE

<u>Set: 5.0</u>

Doors: 29

Description: PR - STOR

6	Hinge, Full Mortise	MPB79 4-1/2" x 4-1/2"	US26D	MK
2	Flush Bolt	555 [12" / 72" AFF]	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom or Closet Lock	AU 4605LN	626	YA
2	Door Stop	409 / 446 as required	US26D	RO
2	Silencer	608		RO

Set: 6.0

Doors: 10, 31, 33 Description: SGL - STOR

3	Hinge, Full Mortise	MPB79 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom or Closet Lock	AU 4605LN	626	YA
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 7.0

Doors: 14, 17, 18, 21, 28, 30, 32, 35, 36, 37, 5, 7 Description: SGL - CLASS

3	Hinge, Full Mortise	MPB79 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	AU 4608LN	626	YA
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 8.0

Doors: 2, 4, 8 Description: SGL - TOILET

3	Hinge, Full Mortise	MPB79 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock/Indicator	LB 49 8265 LNL	US26D	SA
1	Surface Closer	2701 Reg/PA	689	YA
1	Mop Plate	K1050 4" X 1" LDW	US32D	RO
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	S88D		PE

Set: 9.0

Doors: 15 Description: SGL - PRIVACY

3	Hinge, Full Mortise	MPB79 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock	AU 4602LN	626	YA
1	Door Stop	409 / 446 as required	US26D	RO

3	Silencer	608		RO
<u>S</u> D D	e <u>t: 10.0</u> oors: 19, 20 escription: SGL - RESTROOM			
4 1 1 1 1 1 2	Hinge, Full Mortise, Hvy Wt Pull Plate Push Plate Surface Closer Mop Plate Kick Plate Door Stop Silencer	MPB68 4-1/2" x 4-1/2" BF 110 x 70C 70C 2701 Reg/PA K1050 4" X 1" LDW K1050 10" X 2" LDW 409 / 446 as required 608	US26D US32D US32D 689 US32D US32D US26D	MK RO YA RO RO RO
<u>S</u> D D	e <u>t: 11.0</u> oors: 12, 27, 3, 6, 9 escription: SGL - PP -DB			
4 1 1 1 1 1 1 1 3	Hinge, Full Mortise, Hvy Wt Deadbolt Pull Plate Push Plate Surface Closer Mop Plate Kick Plate Door Stop Silencer	MPB68 4-1/2" x 4-1/2" D262 BF 110 x 70C 70C 2701 Reg/PA K1050 4" X 1" LDW K1050 10" X 2" LDW 409 / 446 as required 608	US26D 626 US32D US32D 689 US32D US32D US32D US26D	MK YA RO YA RO RO RO RO

Set: 12.0

Doors: 22, 23, 24, 25 Description: BY OTHERS

1 HBO-Balance

Balance of hardware by door mfg

END OF SECTION 08 71 00

DOOR HARDWARE

DOCUMENT 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Glass for doors and interior borrowed lites.
 - 2. Glazing sealants and accessories.

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) 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.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

DOCUMENT 08 80 00 - GLAZING

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. <u>Manufacturers:</u> 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. AGC Glass Company North America, Inc.
 - 2. <u>Cardinal Glass Industries</u>.
 - 3. <u>JE Berkowitz, LP</u>.
 - 4. <u>Northwestern Industries, Inc</u>.
 - 5. <u>Vetrotech Saint-Gobain</u>.
 - 6. <u>Viracon, Inc</u>.
 - 7. <u>Vitro Architectural Glass</u>.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: Glazing Manual."
- B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
- C. Strength: Where annealed float glass is indicated, provide annealed float glass, heatstrengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heatstrengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seals.
 - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction
 - a. <u>Manufacturers</u>: 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) <u>Technoform</u>.
 - 2) <u>Thermix; a brand of Ensinger USA</u>.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates,

under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

- 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. <u>Manufacturers:</u> 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. <u>Adfast</u>.
 - b. <u>GE Construction Sealants; Momentive Performance Materials Inc</u>.
 - c. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - d. <u>Pecora Corporation</u>.
 - e. <u>Polymeric Systems, Inc</u>.
 - f. Sika Corporation.
 - g. <u>The Dow Chemical Company</u>.
 - h. <u>Tremco Incorporated</u>.

2.7 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.

2.8 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.

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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

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 tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. 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. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

3.6 INSULATING GLASS SCHEDULE

- A. Glass Type: Clear insulating glass.
 - 1. Basis-of-Design Product: Vitro Architectural Glass (PPG Architectural Glass) Solarban 90 Glass..
 - 2. Overall Unit Thickness: **1 inch (25 mm)**.
 - 3. Outdoor Lite: Fully tempered float glass.
 - 4. Interspace Content: Argon.
 - 5. Indoor Lite: Fully tempered float glass.
 - 6. Safety glazing required.

END OF SECTION 08 80 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Silvered flat glass mirrors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.
- C. Samples: For each type of the following:
 - 1. Mirrors: 12 inches (300 mm) square, including edge treatment on two adjoining edges.
 - 2. Mirror Clips: Full size.
 - 3. Mirror Trim: 12 inches (300 mm) long.

1.3 INFORMATIONAL SUBMITTALS

- A. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.
- B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer, who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.
 - 1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. <u>Manufacturers:</u> 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. <u>Avalon Glass and Mirror Company</u>.
 - 2. <u>D & W Incorporated</u>.
 - 3. <u>Lenoir Mirror Company</u>.
 - 4. <u>Walker Glass Co., Ltd</u>.

2.2 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C1503; manufactured using copper-free, low-lead mirror coating process.
- B. Annealed Monolithic Glass Mirrors: Mirror Select Quality, clear.
 - 1. Nominal Thickness: 5.0 mm.
- C. Safety Glazing Products: For film-backed mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors.
 - 1. <u>Manufacturers:</u> 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. <u>C.R. Laurence Co., Inc.; CRH Americas, Inc</u>.
 - b. OSI Sealants; Henkel Corporation.
 - c. <u>Pecora Corporation</u>.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 MIRROR HARDWARE

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Aluminum J Channel Bottom and Side Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
 - a. <u>Manufacturers:</u> 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) <u>Andscot Company, Inc</u>.
 - 2) <u>C.R. Laurence Co., Inc.; CRH Americas, Inc</u>.
 - 3) <u>Stylmark, Inc</u>.

b.

2. Finish: Clear bright anodized.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

2.5 FABRICATION

- A. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.
- B. Mirror Edge Treatment: Rounded polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

- B. Install mirrors with mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
- C. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 08 83 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fixed extruded-aluminum louvers.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
 - 2. Section 081416 "Flush Wood Doors" for louvers in flush wood doors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
- C. Samples: For each type of metal finish required.
- D. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on tests performed according to AMCA 500-L.
- B. Sample warranties.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code Aluminum."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code Stainless Steel."

1.5 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- C. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Design earthquake spectral response acceleration, short period (Sds) for Project as indicated on structural drawings.
 - 2. Component Importance Factor: 1.0.

2.2 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Drainable-Blade Louver See Window Schedule:
 - 1. <u>Manufacturers:</u> 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. <u>Air Balance; MESTEK, Inc</u>.
 - b. <u>Air Flow Company, Inc</u>.
 - c. <u>Airolite Company, LLC (The)</u>.
 - d. <u>NCA Manufacturing, Inc.; Metal Industries, Inc</u>.
 - e. <u>Vent Products Co., Inc</u>.

- 2. Louver Depth: **4 inches (100 mm)**.
- 3. Frame and Blade Nominal Thickness: Not less than **0.060 inch** (**1.52 mm**) for blades and 0.080 inch (2.03 mm) for frames.
- 4. Mullion Type: Exposed.
- 5. Louver Performance Ratings:
 - a. Free Area: Not less than **8.5 sq. ft. (0.79 sq. m)** for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than 950 fpm (4.8 m/s).
 - c. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 850fpm (4.3-m/s) free-area intake velocity.
 - d. Air Performance: Not more than 0.15-inch wg (37-Pa) static pressure drop at 950fpm (4.8-m/s) free-area intake velocity.
- 6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- B. Horizontal, Continuous-Line, Drainable-Blade Louver See Window Schedule: Drainable-blade louver with blade gutters (drains) in rear two-thirds of blades only.
 - 1. <u>Manufacturers:</u> 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. <u>Airline Louvers; Mestek, Inc</u>.
 - b. <u>Airolite Company, LLC (The)</u>.
 - c. <u>All-Lite Architectural Products</u>.
 - d. Arrow United Industries; Mestek, Inc.
 - 2. Louver Depth: **6 inches (150 mm)**.
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
 - 4. Mullion Type: Semirecessed.
 - 5. Louver Performance Ratings:
 - a. Free Area: Not less than **7.8 sq. ft. (0.72 sq. m)** for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than 850 fpm (4.3 m/s).
 - c. Air Performance: Not more than **0.10-inch wg** (**25-Pa**) static pressure drop at **800-fpm** (**4.1-m**/**s**)free-area intake velocity.
 - 6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- C. Horizontal, Wind-Driven-Rain-Resistant Louver See Window Schedule:
 - 1. <u>Manufacturers:</u> 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. <u>Air Balance; MESTEK, Inc</u>.
- b. <u>Air Flow Company, Inc</u>.
- c. <u>Airolite Company, LLC (The)</u>.
- d. <u>NCA Manufacturing, Inc.; Metal Industries, Inc</u>.
- 2. Louver Depth: 4 inches (100 mm).
- 3. Frame and Blade Nominal Thickness: Not less than **0.060 inch (1.52 mm)** for blades and 0.080 inch (2.03 mm) for frames.
- 4. Louver Performance Ratings:
 - a. Free Area: Not less than **7.0 sq. ft. (0.65 sq. m)** for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Air Performance: Not more than **0.10-inch wg** (**25-Pa**) static pressure drop at **800fpm** (**4.1-m**/**s**) free-area intake velocity.
 - c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a core-area intake velocity of **400 fpm (2.0 m/s)**.
- 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.3 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Insect screening.
- B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening for Aluminum Louvers:
 - 1. Bird Screening: Aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.60-mm) wire.

2.4 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5, T-52, or T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
- C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities

calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FABRICATION

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view , threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: Medium bronze.
- B. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 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.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.2 ADJUSTING

A. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION 08 91 19

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Gypsum wallboard.
 - 2. Gypsum board, Type X.
 - 3. Flexible gypsum board.
 - 4. Gypsum ceiling board.
 - 5. Mold-resistant gypsum board.
 - 6. Gypsum board, Type C.
 - 7. Glass-mat gypsum sheathing board.
 - 8. Cementitious backer units.
 - 9. Interior trim.
 - 10. Joint treatment materials.
 - 11. Sound-attenuation blankets.
 - 12. Acoustical sealant.
- B. Sustainable Design Submittals:
- C. Samples: For each texture finish indicated on same backing indicated for Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C1396/C1396M.
 - 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - b. <u>Georgia-Pacific Gypsum LLC</u>.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - d. <u>USG Corporation</u>.
 - 2. Thickness: 1/2 inch (12.7 mm).
 - 3. Long Edges: Tapered.
- B. Flexible Gypsum Board: ASTM C1396/C1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - b. <u>Georgia-Pacific Gypsum LLC</u>.
 - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - d. <u>USG Corporation</u>.
 - 2. Thickness: 1/4 inch (6.4 mm).
 - 3. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C1396/C1396M.
 - 1. <u>Manufacturers:</u> 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. <u>American Gypsum</u>.
 - b. <u>Certainteed; SAINT-GOBAIN</u>.
 - c. <u>Georgia-Pacific Gypsum LLC</u>.
 - d. Gold Bond Building Products, LLC provided by National Gypsum Company.

- 2. Thickness: 1/2 inch (12.7 mm).
- 3. Long Edges: Tapered.
- D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. <u>Manufacturers:</u> 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. <u>American Gypsum</u>.
 - b. <u>Certainteed; SAINT-GOBAIN</u>.
 - c. <u>Georgia-Pacific Gypsum LLC</u>.
 - d. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - e. <u>USG Corporation</u>.
 - 2. Core: 1/2 inch (12.7 mm), regular type.
 - 3. Long Edges: Tapered.
 - 4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
 - 1. <u>Manufacturers:</u> 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. <u>Certainteed; SAINT-GOBAIN</u>.
 - b. <u>Custom Building Products</u>.
 - c. <u>USG Corporation</u>.
 - 2. Thickness: 1/2 inch (12.7 mm).
 - 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 - 2. Shapes:

- a. Cornerbead.
- b. Bullnose bead.
- c. LC-Bead: J-shaped; exposed long flange receives joint compound.
- d. L-Bead: L-shaped; exposed long flange receives joint compound.
- e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
- f. Expansion (control) joint.
- g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 3. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
- E. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."
- F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."
- G. Vapor Retarder: As specified in Section 07 26 00 "Vapor Retarders."
- H. Acoustical Finish: Water-based, chemical-setting or drying-type, job-mixed texture finish for spray application.
 - 1. <u>Manufacturers:</u> 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. <u>International Cellulose Corp</u>.
 - b. <u>USG Corporation</u>.
 - 2. Application Thickness: 1/2 inch (12.7 mm).
 - 3. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 4. NRC: 0.55 according to ASTM C423.

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

- B. Comply with ASTM C840.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) 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. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- E. Prefill open joints, rounded or beveled edges, 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. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Where indicated on Drawings.
 - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
- H. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- I. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

3.3 **PROTECTION**

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Ceramic mosaic tile.
- 2. Glazed wall tile.
- 3. Stone thresholds.
- 4. Tile backing panels.
- 5. Waterproof membranes.
- 6. Crack isolation membranes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples:
 - 1. Each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide samples of each color blend.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.
 - 3. Stone thresholds.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 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 for storage 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.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

- 1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
- 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
- 3. Installer employs only Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers for Project.
- 4. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of membranes and large format tile.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

- A. Factory-Mounted Mosaic Ceramic Tile Type See Finish Schedule: Glazed.
 - 1. <u>Manufacturers:</u> 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. <u>American Olean; a brand of Dal-Tile Corporation</u>.
 - b. <u>Crossville, Inc</u>.
 - c. <u>Daltile; a brand of Dal-Tile Corporation</u>.
 - 2. Composition: Porcelain.
 - 3. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
 - 4. Module Size: See Finish Schedule.
 - 5. Thickness: 1/4 inch (6.4 mm).
 - 6. Face: Pattern of design indicated, with cushion edges.

- 7. Surface: Smooth, without abrasive admixture.
- 8. Dynamic Coefficient of Friction: Not less than 0.42.
- 9. Finish: Bright, clear glaze.
- 10. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
- 11. Grout Color: As selected by Architect from manufacturer's full range.
- 12. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cove: Cove, module size 2 by 1 inch (50.8 by 25.4 mm).
 - b. Base Cap: Bead (bullnose), module size **2** by **2** inches (50.8 by 50.8 mm).
 - c. Wainscot Cap: Bead (bullnose), module size 2 by 2 inches (50.8 by 50.8 mm).
 - d. External Corners for Thinset Mortar Installations: Bead (bullnose), module size 2 by 2 inches (50.8 by 50.8 mm).
 - e. Internal Corners: Cove, module size 2 by 1 inch (50.8 by 25.4 mm).
 - f. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.4 mm) across nominal 4-inch (100-mm) dimension.
- B. Porcelain Tile Type See Finish Schedule: Glazed.
 - 1. <u>Manufacturers:</u> 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. <u>American Olean; a brand of Dal-Tile Corporation</u>.
 - b. <u>Crossville, Inc</u>.
 - c. <u>Daltile; a brand of Dal-Tile Corporation</u>.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - 3. Face Size: See Finish Schedule.
 - 4. Face Size Variation: Rectified.
 - 5. Thickness: 1/4 inch (6.4 mm).
 - 6. Face: Polished with square edges.
 - 7. Dynamic Coefficient of Friction: Not less than 0.42.
 - 8. Tile Color, Glaze, and Pattern: As selected by Architect from manufacturer's full range.
 - 9. Grout Color: As selected by Architect from manufacturer's full range.
 - 10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cap: Surface bullnose, module size same as adjoining flat tile.
 - b. Wainscot Cap: Surface bullnose, module size same as adjoining flat tile.
 - c. External Corners: Surface bullnose, module size same as adjoining flat tile.
 - d. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide

reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.4 mm) across nominal 4-inch (100-mm) dimension.

- C. Glazed Wall Tile Type See Finish Schedule:
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. American Olean; a brand of Dal-Tile Corporation.
 - b. <u>Daltile; a brand of Dal-Tile Corporation</u>.
 - c. <u>Grupo Porcelanite</u>.
 - 2. Module Size: See Finish Schedule.
 - 3. Face Size Variation: Rectified.
 - 4. Thickness: 5/16 inch (8 mm).
 - 5. Face: Pattern of design indicated, with manufacturer's standard edges.
 - 6. Finish: Bright, clear glaze.
 - 7. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
 - 8. Grout Color: As selected by Architect from manufacturer's full range.
 - 9. Mounting:
 - a. Factory, back mounted.
 - b. Pregrouted sheets of tiles are factory assembled and grouted with manufacturer's standard white silicone rubber.
 - 10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base: Coved, module size 6 by 2 inches (152 by 51 mm).
 - b. Wainscot Cap: Bullnose cap, module size 6 by 2 inches (152 by 51 mm).
 - c. External Corners: Surface bullnose, same size as adjoining flat tile.
 - d. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.
- D. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as used for adjoining wall tile.
 - 1. One soap holder with grab handle for each shower and tub indicated.
 - 2. One paper holder at each water closet.
 - 3. Color and Finish: As selected by Architect from manufacturer's full range.

2.3 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 (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of 12 according to ASTM C1353 or ASTM C241/C241M and with honed finish.
 - 1. Description:
 - a. Uniform, fine- to medium-grained white stone with gray veining.
 - b. Match Architect's sample.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A.
 - 1. <u>Manufacturers:</u> 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. <u>C-Cure</u>.
 - b. <u>Custom Building Products</u>.
 - c. <u>Georgia-Pacific Gypsum LLC</u>.
 - d. <u>USG Corporation</u>.
 - 2. Thickness: 5/8 inch (15.9 mm).

2.5 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Waterproof Membrane, PVC Sheet: PVC heat-fused on both sides to facings of nonwoven polyester.
 - 1. <u>Manufacturers:</u> 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. <u>Compotite Corporation</u>.
- b. <u>Noble Company (The)</u>.
- 2. Nominal Thickness: **0.040 inch (1 mm)**.

2.6 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Crack Isolation Membrane, Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 - 1. <u>Manufacturers:</u> 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. <u>Noble Company (The)</u>.

2.7 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
- B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
 - 1. <u>Manufacturers:</u> 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. <u>Bostik; Arkema</u>.
 - b. <u>C-Cure</u>.
 - c. <u>Laticrete International, Inc</u>.
 - 2. For wall applications, provide nonsagging mortar.

2.8 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

- 1. <u>Manufacturers:</u> 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. <u>ARDEX Americas</u>.
 - b. <u>Bostik; Arkema</u>.
 - c. <u>C-Cure</u>.
 - d. <u>Laticrete International, Inc</u>.
- C. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.9 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. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless steel, ASTM A276/A276M or ASTM A666, 300 Series exposed-edge material.
 - 1. <u>Manufacturers:</u> 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. <u>Blanke Corporation</u>.
 - b. <u>Ceramic Tool Company, Inc</u>.
 - c. <u>Schluter Systems L.P.</u>
- C. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 - 1. <u>Manufacturers:</u> 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. <u>Laticrete International, Inc</u>.
 - b. <u>Sakrete; CRH Americas, Oldcastle APG</u>.
 - c. <u>Southern Grouts & Mortars, Inc</u>.
 - d. <u>Summitville Tiles, Inc</u>.

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 the Work.
 - 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.
 - 2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA 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 TCNA 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. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
- c. Tile floors consisting of rib-backed tiles.
- 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. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.
- F. 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.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm).
 - 2. Glazed Wall Tile: 1/8 inch (3.2 mm).
 - 3. Porcelain Tile: 1/4 inch (6.4 mm).
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. 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.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - 1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in modified dry-set mortar (thinset).
 - 2. Do not extend waterproof membrane or crack isolation membrane under thresholds set in standard dry-set or improved modified dry-set mortar. Fill joints between such thresholds

and adjoining tile set on waterproof membrane or crack isolation membrane with elastomeric sealant.

- K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- L. Floor Sealer: Apply floor sealer to grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- M. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.
- N. Install waterproof membrane to comply with ANSIA108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- O. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

END OF SECTION 09 30 13

DOCUMENT 09 51 1 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section includes acoustical panels and exposed suspension systems for interior 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.
- C. Delegated-Design Submittal: For seismic restraints for ceiling systems.
 - 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.
- B. Product test reports.
- C. Research reports.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

DOCUMENT 09 51 1 – ACOUSTICAL PANEL CEILINGS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.
- B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E1264.
 - 2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS - SC-1:

- A. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - 1. <u>USG Corporation</u>; Premier Hi-Lite Panels.
- B. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E1264.
- C. Classification: Class A.
- D. Color: As selected from manufacturer's full range.
- E. Light Reflectance (LR): 0.76.
- F. Ceiling Attenuation Class (CAC): 25 or Less.
- G. Noise Reduction Coefficient (NRC): 0.50-0.70.
- H. Articulation Class (AC): 200 or Greater.
- I. Edge/Joint Detail: Square.
- J. Thickness: **3/4 inch (19 mm)**.
- K. Modular Size: 24 by 24 inches (610 by 610 mm)

DOCUMENT 09 51 1 – ACOUSTICAL PANEL CEILINGS

2.3 ACOUSTICAL PANELS - SC-2 (Scrubable Tile):

- A. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - 1. <u>USG Corporation</u>; USG Mars Panels.
- B. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E1264.
- C. Classification: Type IV.
- D. Color: As selected from manufacturer's full range.
- E. Light Reflectance (LR): 0.90.
- F. Ceiling Attenuation Class (CAC): 30 35.
- G. Noise Reduction Coefficient (NRC): 0.80-0.90.
- H. Articulation Class (AC): 200 or Greater.
- I. Edge/Joint Detail: Square.
- J. Thickness: **3/4 inch (19 mm)**.
- K. Modular Size: 24 by 24 inches (610 by 610 mm)

2.4 METAL SUSPENSION SYSTEM

- A. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - 1. USG Corporation; Donn Brand DXSS Acoustical Suspension System.
- B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M.
- C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: butt-edge type.
 - 3. Face Design: Flat, flush.
DOCUMENT 09 51 1 – ACOUSTICAL PANEL CEILINGS

- 4. Cap Material: Cold-rolled steel.
- 5. Cap Finish: Painted in color as selected from manufacturer's full range.

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Hold-Down Clips: Manufacturer's standard hold-down.
- C. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- D. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.
- B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
- B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

DOCUMENT 09 51 1 – ACOUSTICAL PANEL CEILINGS

- 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
- 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- 3. Arrange directionally patterned acoustical panels as follows:
 - a. Install panels in a basket-weave pattern.
- 4. Install hold-down, impact and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform inspections.
 - 1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.

END OF SECTION 09 51 13

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoplastic-rubber base.
 - 2. Rubber stair accessories.
 - 3. Rubber molding accessories.

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.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE:

- A. <u>Manufacturers:</u> 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. <u>Armstrong Flooring, Inc</u>.
 - 2. <u>Roppe Corporation</u>.
- B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient floor coverings.
- C. Thickness: **0.125 inch (3.2 mm)**.
- D. Height: 4 inches (102 mm).
- E. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

- F. Outside Corners: Job formed or preformed.
- G. Inside Corners: Job formed or preformed.
- H. Colors: Match Architect's selection in the Finish Schedule.

2.2 RUBBER STAIR ACCESSORIES

- A. <u>Manufacturers:</u> 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. <u>Armstrong World Industries, Inc</u>.
 - 2. <u>Flexco</u>.
 - 3. <u>Roppe Corporation</u>.
- B. Stair Treads: ASTM F2169.
 - 1. Type: TP (rubber, thermoplastic).
 - 2. Class: 2 (pattern; embossed, grooved, or ribbed).
 - 3. Group: 2 (with contrasting color for the visually impaired).
 - 4. Nosing Style: Round.
 - 5. Nosing Height: 1-1/2 inches (38 mm).
 - 6. Thickness: 1/4 inch (6 mm) and tapered to back edge.
 - 7. Size: Lengths and depths to fit each stair tread in one piece.
- C. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
 - 1. Style: Coved toe, 7 inches (178 mm) high by length matching treads.
 - 2. Thickness: Manufacturer's standard.
- 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: Match Architect's selection in Finish Schedule.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stairtread manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of 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. Preformed Corners: Install preformed corners before installing straight pieces.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than **3 inches (76 mm)**in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than **3 inches (76 mm)** in length.

a. Miter or cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.
 - 1. Apply two coat(s) in accordance with material manufacturers recommendations.
- C. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

DOCUMENT 09 65 19 – RESILIENT TILE FLOORING

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PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Samples: For each exposed product and for each color and pattern specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

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2.2 VINYL COMPOSITION FLOOR TILE; VCT- 1, 2, 3 & 4:

- A. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - 1. <u>Armstrong World Industries, Inc</u>; EXCELON FEATURE TILE:
- B. Tile Standard: ASTM F 1066, Class 2, through pattern.
- C. Wearing Surface: Smooth.
- D. Thickness: **0.125 inch (3.2 mm)**.
- E. Size: 12 by 12 inches (305 by 305 mm).
- F. Colors and Patterns: As indicated on Architect's Finish Schedule.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

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.

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- 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: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of **3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)** in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 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.

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- 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 installation 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 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.
- I. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply two coat(s).

END OF SECTION 09 65 19

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. 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.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.
- C. Samples: For each exposed product and for each color and texture required.

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: Certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 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 Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 CARPET TILE See Finish Schedule on Drawings:
 - A. <u>Manufacturers:</u> 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. <u>Bentley Mills, Inc</u>.
 - 2. <u>Interface, Inc</u>.
 - 3. <u>Mannington Mills, Inc</u>.
 - 4. <u>Milliken & Company</u>.
 - 5. Mohawk Carpet, LLC; The Mohawk Group.
 - 6. <u>Patcraft; a division of Shaw Industries, Inc</u>.
 - 7. <u>Shaw Industries Group, Inc.; Berkshire Hathaway Company</u>.
 - B. Color: As selected by Architect from manufacturer's full range.
 - C. Pattern: Match Architect's samples.
 - D. Fiber Content: Match Product content as Basis of Design indicated in Finish Schedule on Drawings.
 - E. Size: 24 by 24 inches (610 by 610 mm).
 - F. Applied Treatments:

- 1. Soil-Resistance Treatment: Manufacturer's standard treatment.
- 2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
 - a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
- G. Sustainable Design Requirements:
- H. Performance Characteristics:
 - 1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
 - 2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
 - 3. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D2646.
 - 4. Tuft Bind: Not less than **8 lbf** (**36 N**) according to ASTM D1335.
 - 5. Delamination: Not less than **4 lbf/in. (0.7 N/mm)** according to ASTM D3936.
 - 6. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
 - 7. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
 - 8. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
 - 9. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
 - 10. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

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 comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Concrete Slabs:

- 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of **3 lb of** water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- B. Wood Subfloors: Verify that underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- C. Metal Subfloors: Verify that underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- D. Painted Subfloors: Perform bond test recommended in writing by adhesive manufacturer.
 - 1. Access Flooring Systems: Verify access floor substrate is compatible with carpet tile and adhesive, if any, and underlayment surface is gaps greater than 1/8 inch (3 mm) and protrusions more than 1/32 inch (0.8 mm).

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. 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.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.
- I. Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.
- J. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, fabric-wrapped wall panels.

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 panel assembly and installation.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: 25 or less.
- b. Smoke-Developed Index: 450 or less.
- 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 FABRIC-WRAPPED WALL PANELS

- A. Fabric-Wrapped Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core] [stretched over front face of edge-framed core and bonded or attached to edges and back of frame.
 - 1. <u>Manufacturers:</u> 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. <u>Acoustical Panel Systems (APS, Inc.)</u>.
 - b. <u>Acoustical Solutions</u>.
 - c. <u>Armstrong Ceiling & Wall Solutions</u>.
 - d. <u>Decoustics; CertainTeed Architectural Products; a Saint Gobain company</u>.
 - e. <u>Panel Solutions, Inc</u>.
 - 2. Mounting: Edge mounted with splines secured to substrate.
 - 3. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
 - 4. Core: Manufacturer's standard Retain "Core-Face Layer" Subparagraph below if different face layer is required for the core material to make the panels impact resistant, tackable, or both.
 - a. Core-Face Layer: Manufacturer's standard tackable, impact-resistant, high-density board.
 - 5. Edge Construction: Manufacturer's standard wood frame, rabbeted, and splined with glued joints and machined corners.
 - 6. Edge Profile Radiused (bullnosed).
 - 7. Corner Detail in Elevation: Square with continuous edge profile indicated.
 - 8. Reveals between Panels: Recessed reveals as selected by Architect from manufacturer's full range
 - 9. Facing Material: As indicated on Drawings.
 - 10. Nominal Core Thickness: 3/4 inch (19 mm).

2.3 MATERIALS

A. Core Materials: Manufacturer's standard.

- B. Facing Material Per Finish Schedule: Fabric from same dye lot; color and pattern as selected by Architect from manufacturer's full range.
 - 1. Applied Treatments: Stain resistance.
 - 2. Lining Material: Manufacturer's standard fabric for each use indicated.
- C. Mounting Devices: Concealed on back of panel, recommended by manufacturer to support weight of panel, and as follows:

2.4 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.
- C. Facing Material and Lining Material: Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
 - 1. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.
- D. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch (1.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.
- C. Align fabric pattern and grain with adjacent panels.

3.2 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 77 23

DOCUMENT 09 91 13 – EXTERIOR PAINTING

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Fiber-cement board.
 - 2. Steel and iron.
 - 3. Galvanized metal.
 - 4. Aluminum (not anodized or otherwise coated).
 - 5. Copper.
 - 6. Stainless steel.
 - 7. Wood.
 - 8. Plastic.
 - 9. Portland cement plaster (stucco).
 - 10. Gypsum board.

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

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- 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint system and each color and gloss of topcoat.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Finish Schedule located on the Finish Drawings for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

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- 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As indicated in a color schedule.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Masonry (Clay and CMUs): 12 percent.
 - 4. Wood: 15 percent.
 - 5. Portland Cement Plaster: 12 percent.
 - 6. Gypsum Board: 12 percent.
 - C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
 - D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

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3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
- B. 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.

3.4 CLEANING AND PROTECTION

- A. 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.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 13

DOCUMENT 09 91 23 – INTERIOR PAINTING

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on following interior substrates:
 - 1. Wood.
 - 2. Gypsum board.
 - 3. Plaster.
 - 4. Concrete Block

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint system and in each color and gloss of topcoat.

DOCUMENT 09 91 23 – INTERIOR PAINTING

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1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. <u>Products:</u> Subject to compliance with requirements, provide the following:
 - 1. <u>Sherwin-Williams Company (The)</u>; Drywall Primer, ProMar® 400 Interior Latex Low Sheen, B20W04251.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As indicated in a color schedule.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Masonry (Clay and CMUs): 12 percent.
 - 4. Wood: 15 percent.
 - 5. Gypsum Board: 12 percent.
 - 6. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

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B. 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.

END OF SECTION 09 91 23

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Primers
 - 2. Wood stains.
 - 3. Transparent finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of finish system and in each color and gloss of finish required.
- C. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. <u>Manufacturers:</u> 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. <u>Behr Paint Company; Behr Process Corporation</u>.
 - 2. <u>Benjamin Moore & Co</u>.
 - 3. <u>PPG Paints; PPG Industries, Inc</u>.
 - 4. <u>Rust-Oleum Corporation; a subsidiary of RPM International, Inc.</u>
 - 5. <u>Sherwin-Williams Company (The)</u>.

2.2 MATERIALS, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

В.

C. Stain Colors: As selected by Architect from manufacturer's full range.

2.3 WOOD STAINS

- A. Stain, Interior, Semitransparent, for Interior Wood: Solvent-based, oil or oil/alkyd, semitransparent, pigmented stain for new interior wood surfaces that are to be finished with a clear varnish.
 - 1. <u>Manufacturers:</u> 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. <u>PPG Paints; PPG Industries, Inc</u>.
 - b. <u>Pratt & Lambert; a subsidiary of The Sherwin-Williams Company</u>.
 - c. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
 - d. <u>Sherwin-Williams Company (The)</u>.

2.4 TRANSPARENT FINISHES

- A. Varnish, Interior Polyurethane, Moisture Cured, Gloss: Solvent-based, moisture-curing polyurethane clear-coating with a gloss finish for interior wood surfaces,
 - 1. <u>Manufacturers:</u> 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. <u>Benjamin Moore & Co</u>.
 - b. <u>Sherwin-Williams Company (The)</u>.
 - 2. Gloss Level: Manufacturer's standard gloss finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- B. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

3.2 PREPARATION

- A. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- B. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
 - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

- A. Wood Substrates, Architectural Woodwork, Doors, Windows and Wood Board Paneling:
 - 1. Water-Based Varnish over Stain System:
 - a. Stain Coat: Stain, semitransparent, for interior wood.
 - b. First Intermediate Coat: Water-based varnish matching topcoat.
 - c. Second Intermediate Coat: Water-based varnish matching topcoat.

d. Topcoat: Varnish, water based, clear, semigloss.

END OF SECTION 09 93 00

DOCUMENT 10 14 19 – DIMENSIONAL LETTER SIGNAGE

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast dimensional characters.
 - 2. Cutout dimensional characters.
 - 3. Fabricated channel dimensional characters.
 - 4. Illuminated, fabricated channel dimensional characters.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
- C. Shop Drawings: For signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show locations of electrical service connections.
 - 4. Include diagrams for power, signal, and control wiring.
- D. Samples: For each exposed product and for each color and texture specified.
- E. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article.
 - 1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

DIMENSIONAL LETTER SIGNAGE

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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. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of dimensional character sign type(s) according to structural performance requirements.
- B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
- C. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DIMENSIONAL CHARACTERS

- A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 - 1. <u>Manufacturers:</u> 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. <u>A.R.K. Ramos</u>.
 - b. <u>ACE Sign Systems, Inc</u>.
 - c. <u>Metal Arts</u>.
 - d. <u>Metallic Arts</u>.
 - e. <u>Southwell Company (The)</u>.

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- 2. Character Material: Cast aluminum.
- 3. Character Height: As indicated on Drawings.
- 4. Finishes:
 - a. Integral Aluminum Finish: Clear anodized.
- 5. Mounting: As indicated on Drawings.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel 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, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

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- 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
- 4. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
- 5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- 6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
 - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color color unless otherwise 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.

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- b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
- 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
- 3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
- 4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
- 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
- C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 10 14 19
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.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachment details.
- C. Samples for each type of toilet compartment material indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 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 ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARMENTS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. ASI Accurate Partitions.
 - 2. ASI Global Partitions.
 - 3. <u>Bobrick Washroom Equipment, Inc</u>.
 - 4. <u>Bradley Corporation</u>.
- B. Toilet-Enclosure Style: Overhead braced.
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.
- E. Pilaster Shoes and Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
- F. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.
- G. Phenolic-Panel Finish:
 - 1. Facing Sheet Finish: One color and pattern in each room.
 - 2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.
 - 3. Edge Color: Manufacturer's standard.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
 - 1. Material: Stainless steel.
 - 2. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
- B. Hardware and Accessories: Manufacturer's heavy-duty stainless steel operating hardware and accessories.

- 1. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
- C. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- D. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide inswinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) 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.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch (13 mm).
 - b. Panels and Walls: 1 inch (25 mm).
 - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with fullheight brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.

b. Align brackets at pilasters with brackets at walls.

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 to return doors to fully closed position.

END OF SECTION 10 21 13.17

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manually operated, acoustical panel partitions.

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 operable panel partitions.
 - 1. Include plans, elevations, sections, attachment details.
 - 2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Delegated-Design Submittal: For operable panel partitions.
 - 1. Include design calculations for seismic restraints that brace tracks to structure above.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Setting Drawings: For embedded items and cutouts required in other work, including supportbeam, mounting-hole template.
- C. Seismic Qualification Certificates: For operable panel partitions, tracks, accessories, and components, from manufacturer.
- D. Product Certificates: For each type of operable panel partition.

FOLDING PANEL PARTITIONS

- E. Product test reports.
- F. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- 1.6 QUALITY ASSURANCE
 - A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

- 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - Moduflex Series 800 with STC of 55, manufactured by Panelfold, Inc., 10700 N.
 W., 36th Avenue, Miami, Florida 33167, Telephone (305) 688-3501, Fax (305) 688-0185, <u>info@panelfold.com</u>

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic bracing of tracks to structure above.
- B. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the partition panels will remain in place without separation of any parts when subjected to the seismic forces specified."

- C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.
 - 2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C423, and rated for not less than the NRC indicated.

2.3 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
- B. Panel Operation: Manually operated, paired panels.
- C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
- E. STC: Not less than 55.
- F. NRC: Not less than 0.90.
- G. Panel Materials:
 - 1. Steel Frame: Steel sheet, manufacturer's standard thickness.
 - 2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard thickness.
 - 3. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; manufacturer's standard strengths and thicknesses for type of use.
 - 4. Gypsum Board: ASTM C1396/C1396M.
 - 5. Cement Board: ASTM C1288.
 - 6. Particleboard: ANSI A208.1.
 - 7. Medium-Density Fiberboard: ANSI A208.2.
 - 8. Plywood: DOC PS 1.
- H. Panel Closure: Manufacturer's standard.

- I. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
- J. Finish Facing: Fabric wall covering.
- 2.4 PANEL FINISH FACINGS
 - A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
 - B. Fabric Wall Covering: Manufacturer's standard fabric, from same dye lot, treated to resist stains.
 - 1. Color/Pattern: As selected by Architect from manufacturer's full range.
 - C. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing.
 - D. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

- A. Tracks: Steel or aluminum mounted directly to overhead structural support, with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch (2.54 mm) between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- B. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- C. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.
- D. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.2 ADJUSTING

- A. Adjust to operate smoothly and easily, without binding or warping.
- B. Verify that safety devices are properly functioning.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 10 22 39

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Private-use bathroom accessories.
 - 3. Childcare accessories.
 - 4. Underlavatory guards.
 - 5. Custodial accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each finish specified, full size.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Delegated Design Submittal: For grab bars.
 - 1. Include structural design calculations indicating compliance with specified structuralperformance requirements.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranties.
- 1.4 CLOSEOUT SUBMITTALS
 - A. Maintenance data.

1.5 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 2 - PRODUCTS

2.1 PERFORMANCE 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. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Toilet Tissue (Roll) Dispenser **T-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - d. Tubular Specialties Manufacturing, Inc.
 - 2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
 - 3. Mounting: Surface mounted.
 - 4. Operation: Noncontrol delivery with standard spindle] [Noncontrol delivery with theft-resistant spindle.
 - 5. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
 - 6. Material and Finish: Satin-finish aluminum bracket with plastic spindle.
- B. Paper Towel (Folded) Dispenser **PT-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.

- 2. Mounting: Surface mounted.
- 3. Minimum Capacity: 400 C-fold or 525 multifold towels.
- 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- 5. Lockset: Tumbler type.
- 6. Refill Indicator: Pierced slots at sides or front.
- C. Waste Receptacle **WR-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Mounting: Freestanding.
 - 3. Minimum Capacity: 13 Gallon.
 - 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - 5. Liner: Reusable vinyl liner.
 - 6. Lockset: Tumbler type for waste receptacle.
- D. Combination Towel (Folded) Dispenser/Waste Receptacle **PT-2**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
 - 3. Mounting: Surface mounted.
 - 4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
 - 5. Minimum Waste-Receptacle Capacity: 4 gal. (15 L)] [12 gal. (45.4 L).
 - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - 7. Liner: Reusable, vinyl waste-receptacle liner.
 - 8. Lockset: Tumbler type for towel-dispenser compartment.
- E. Soap Dispenser **SD-1**:

- 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
- 2. Description: Designed for manual operation and dispensing soap in lather form.
- 3. Mounting: Vertically oriented, surface mounted.
- 4. Capacity: 42 Fl Ounces.
- 5. Materials: High Impact Resistant ABS.
- 6. Lockset: Tumbler type.
- 7. Refill Indicator: Window type.
- F. Grab Bar **GB-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc.</u>
 - c. <u>Bradley Corporation</u>.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - 4. Outside Diameter: 1-1/2 inches (38 mm).
 - 5. Configuration and Length: Straight, <u>36 inches (914 mm)</u> long.
- G. Sanitary-Napkin Disposal Unit **NP-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Mounting: Surface mounted.

- 3. Door or Cover: Self-closing, disposal-opening cover.
- 4. Receptacle: Removable.
- 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- H. Seat-Cover Dispenser **SC-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Mounting: Surface mounted.
 - 3. Minimum Capacity: 250 seat covers.
 - 4. Exposed Material and Finish: ABS plastic, gray.
 - 5. Lockset: Tumbler type.
- I. Mirror Unit **MR-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Frame: Stainless steel channel.
 - a. Corners: Manufacturer's standard.
 - 3. Size: 24" X 36".
 - 4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.
- J. Hook **H-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.

- 2. Description: Combination hat and coat hook.
- 3. Mounting: Exposed.
- 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.3 PRIVATE-USE BATHROOM ACCESSORIES

- A. Private-Use Toilet Tissue Dispenser **T-2**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Description: Double-roll dispenser with the following features:
 - a. Hood.
 - 3. Mounting: Surface mounted.
 - 4. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
 - 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- B. Private-Use Shower Curtain Rod **CR-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Description: 1-1/4-inch- (32-mm-) outside diameter, straight rod.
 - 3. Configuration: As indicated on Drawings
 - 4. Mounting Flanges: Designed for concealed fastening, in manufacturer's standard material and finish.
 - 5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - 6. Features: Integral chrome-plated brass glide hooks.
- C. Private-Use Soap Dish **SD-1**:

- 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc.</u>
 - c. <u>Bradley Corporation</u>.
- 2. Description: Bobrick Model **B-6807**.
- 3. Mounting: Surface mounted.
- 4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- D. Private-Use Medicine Cabinet MC-1:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Mounting: Recessed, for nominal 4-inch (100-mm) wall depth.
 - 3. Size: 18 by 24 inches (457 by 610 mm).
 - 4. Door: Framed mirror door concealing storage cabinet equipped with continuous hinge and spring-buffered, rod-type stop and magnetic door catch.
 - 5. Shelves: Three, adjustable.
 - 6. Material and Finish:
 - a. Cabinet: Steel with corrosion-resistant finish.
- E. Private-Use Robe Hook **RH-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Description: Double-prong unit.
 - 3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- F. Private-Use Toothbrush and Tumbler Holder **TB-1**:

- 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bradley Corporation</u>.
 - c. <u>Brey-Krause Manufacturing Co</u>.
- 2. Description: Bradley Model No. 9044.
- 3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- G. Private-Use Towel Bar **TWL-1**:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
 - 2. Description: 3/4-inch- (19-mm-) square tube with rectangular end brackets.
 - 3. Mounting: Flanges with concealed fasteners.
 - 4. Length: **30 inches (762 mm)**.
 - 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- H. Private-Use Towel Rack Insert drawing designation:
 - 1. <u>Manufacturers:</u> 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. <u>Aluids; Krome USA Inc</u>.
 - b. <u>Basco, Inc</u>.
 - c. <u>Taymore Industries USA Inc</u>.
 - d. <u>Tubular Specialties Manufacturing, Inc</u>.
 - 2. Description: Surface-mounted, guest-towel unit with approximately 1/4-inch- (6-mm-) diameter wire rings welded to upright wire bracket.
 - 3. Capacity: Two sets of bath towels, hand towels, and washcloths.
 - 4. Nominal Height: 21 inches (533 mm).
 - 5. Material and Finish: Polished chrome-plated zinc alloy (zamac).

2.4 CHILDCARE ACCESSORIES

- A. Diaper-Changing Station CHS-1:
 - 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bradley Corporation</u>.
 - 2. Description: Vertical unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of **250-lb** (**113-kg**) static load when opened.
 - 3. Mounting: Surface mounted, with unit projecting not more than 4 inches (102 mm) from wall when closed.
 - 4. Operation: By pneumatic shock-absorbing mechanism.
 - 5. Material and Finish: HDPE in manufacturer's standard color.
 - 6. Liner Dispenser: Provide separate, locking dispenser for disposable sanitary liners.

2.5 UNDERLAVATORY GUARDS

- A. Underlavatory Guard **UG-1**:
 - 1. <u>Manufacturers:</u> 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. <u>Buckaroos, Inc</u>.
 - b. <u>Plumberex Specialty Products, Inc</u>.
 - c. <u>Truebro by IPS Corporation</u>.
 - 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
 - 3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 CUSTODIAL ACCESSORIES

A. Custodial Mop and Broom Holder **MB-1**:

- 1. <u>Manufacturers:</u> 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. <u>ASI Group</u>.
 - b. <u>Bobrick Washroom Equipment, Inc</u>.
 - c. <u>Bradley Corporation</u>.
- 2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
- 3. Length: **36 inches (914 mm)**.
- 4. Hooks: Four.
- 5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
- 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
 - b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.7 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.
 - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Shower Seats: Install to comply with specified structural-performance requirements.

END OF SECTION 10 28 00

A NEW WORSHIP FACILITY FOR TABERNACLE BAPTIST CHURCH SELMA, ALABAMA PROJECT NUMBER 10238.00/5.1 Page 1 of 3

DOCUMENT 10 44 13 – FIRE PROTECTION CABINETS

Page 1 of 3

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.

1.5 SEQUENCING

A. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

A NEW WORSHIP FACILITY FOR TABERNACLE BAPTIST CHURCH SELMA, ALABAMA PROJECT NUMBER 10238.00/5.1 Page 2 of 3

DOCUMENT 10 44 13 – FIRE PROTECTION CABINETS

Page 2 of 3

2.2 FIRE-PROTECTION CABINET: FEC.

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. <u>Manufacturers:</u> 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. <u>Larsens Manufacturing Company</u>.
- 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. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
- E. Cabinet Trim Material: Stainless-steel sheet.
- F. Door Material: Stainless-steel sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Tempered float glass (clear).
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- 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: Pressure-sensitive vinyl letters.

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DOCUMENT 10 44 13 – FIRE PROTECTION CABINETS

Page 3 of 3

- 3) Lettering Color: Red.
- 4) Orientation: Vertical.

K. Materials:

- 1. Stainless Steel: ASTM A 666, Type 304.
 - a. Finish: No. 4 directional satin finish.
- 2. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, 3 mm thick.
- 3. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).
- 4. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.3 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 10 44 13

DOCUMENT 10 44 16 – FIRE EXTINGUISHERS

Page 1 of 3

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section includes portable, hand-carried 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.

DOCUMENT 10 44 16 – FIRE EXTINGUISHERS

Page 2 of 3

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 indicated.
 - 1. <u>Manufacturers</u>: 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. Larsens Manufacturing Company MP-20.
 - 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.
- B. Multipurpose Dry-Chemical Type: UL-rated 20 lbs. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

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 in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher cabinet.

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DOCUMENT 10 44 16 – FIRE EXTINGUISHERS

Page 3 of 3

END OF SECTION 10 44 16

DOCUMENT 11 30 13 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cooking appliances.
 - 2. Refrigeration appliances.

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 certificates.
- B. Field quality-control reports.
- C. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

1.7 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

RESIDENTIAL APPLIANCES

DOCUMENT 11 30 13 - RESIDENTIAL APPLIANCES

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 COOKTOPS

2.3 MICROWAVE OVENS

- A. Microwave Oven:
 - 1. <u>Manufacturers:</u> 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. <u>Amana; Whirlpool Corporation</u>.
 - b. <u>Frigidaire</u>.
 - c. <u>GE Appliances; Haier Group</u>.
 - d. <u>Kenmore; Transformco SR Brands LLC</u>.
 - e. Whirlpool Corporation.
 - 2. Mounting: Undercabinet.
 - 3. Capacity: **2.0 cu. ft. (0.06 cu. m**).
 - 4. Exhaust Fan: Variable-speed fan, recirculating type with charcoal filter and with manufacturer's standard capacity.
 - 5. Microwave Power Rating: 1000 W.
 - 6. Material: Stainless steel.

2.4 REFRIGERATOR/FREEZERS

- A. Refrigerator/Freezer: One-door refrigerator with freezer compartment inside and complying with AHAM HRF-1.
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

DOCUMENT 11 30 13 – RESIDENTIAL APPLIANCES

- a. <u>Amana; Whirlpool Corporation</u>.
- b. <u>Frigidaire</u>.
- c. <u>GE Appliances; Haier Group</u>.
- d. Kenmore; Transformco SR Brands LLC.
- e. <u>KitchenAid; Whirlpool Corporation</u>.
- 2. Type: Undercounter.
- 3. Storage Capacity:
 - a. Refrigeration Compartment Volume: **4.6 cu. ft. (0.44 cu. m)**.
- 4. General Features:
 - a. Interior light in refrigeration compartment.
 - b. Automatic defrost.
- 5. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
- 6. Front Panel(s): **Stainless steel**.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- C. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.

A NEW WORSHIP FACILITY FOR TABERNACLE BAPTIST CHURCH SELMA, ALABAMA PROJECT NUMBER 10238.00/5.1 Page 4 of 4

DOCUMENT 11 30 13 - RESIDENTIAL APPLIANCES

- 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 11 30 13

DOCUMENT 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.
 - 4. Solid surface material apron fronts.
 - 5. Solid surface material window stools.
 - 6. Solid Surface material stair treads.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops, window stools and stair treads. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 SOLID SURFACE MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
 - 1. <u>Manufacturers:</u> 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. <u>DuPont; DuPont de Nemours, Inc</u>.
 - b. <u>Durasein Solid Surface; a brand of Relang International, LLC</u>.
 - c. <u>Formica Corporation</u>.
 - d. <u>Wilsonart LLC</u>.
 - 2. Type: Provide ³/₄" thick minimum material unless Special Purpose type is indicated.
 - 3. Colors and Patterns: As selected by Architect from manufacturer's full range.
- B. Particleboard: ANSI A208.1, Grade M-2.

DOCUMENT 12 36 61.16 – SOLID SURFACING COUNTERTOPS

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

- A. Fabricate countertops, window stools and stair treads according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Custom.
- B. Configuration:
 - 1. Front: **3/4-inch (19-mm)** bullnose.
 - 2. Backsplash: Beveled.
 - 3. End Splash: Matching backsplash.
- C. Countertops:
 - 1. **3/4-inch-** (19-mm-) thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 3/4-inch- (19-mm-) thick, solid surface material.
- E. Joints:
 - 1. Fabricate countertops in sections for joining in field.
- F. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures[**in shop**] using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

DOCUMENT 12 36 61.16 – SOLID SURFACING COUNTERTOPS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.
- B. Fasten subtops to miscellaneous framing by screwing through subtops into cornerblocks of base cabinets or stair framing. Shim as needed to align in a level plane.
- C. Secure solid surfacing material to subtops and framing with adhesive according to solid surface material manufacturer's written instructions.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.
- F. Install aprons to backing and countertops with adhesive.
- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 12 36 61.16

DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1-GENERAL

SCOPE

P

This section includes information common to two or more technical fire protection specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

The specifications and drawings are scope documents based on the Owner's requirements for the fire protection systems. It is the intent of the documents to detail and specify the minimum requirements and components. It is the responsibility of the Contractor to design and install a complete fire protection system in compliance with NFPA, State, and the Local Authority Having Jurisdiction codes and requirements. Pipe and equipment sizing shown in the documents is the minimum allowed. If larger size is required, it is to be included in the bid.

Included are the following topics:

ART 1 - GENERAL		
S	Scope	
F	Related Work	
F	Reference	
F	Reference Standards	
C	Quality Assurance	
C	Continuity of Existing Services	
F	Protection of Finished Surfaces	
S	Sleeves and Openings	
S	Sealing and Fire Stopping	
E	Equipment Furnished by Others	
F	Provisions for Future	

0 [.]	DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION off Site Storage
Co	odes
D	esign Criteria
Te	emporary Standpipes
Ce	ertificates and Inspections
Su	ubmittals
0	perating and Maintenance Instructions
Tr	raining of Owner Personnel
Re	ecord Drawings
PART 2 - P	PRODUCTS
A	ccess Panels and Doors
Id	lentification
Se	ealing and Fire Stopping
PART 3 - E	EXECUTION
De	emolition
Co	oncrete Work
Cu	utting and Patching
В	uilding Access
Ec	quipment Access
Co	oordination
Id	lentification
Lu	ubrication
SI	leeves and Openings
Se	ealing and Fire Stopping
Сс	onstruction Verification Items
0'	wner Training

DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

RELATED WORK

This section applies to all Division 21 sections of fire suppression.

- Section 07 84 00 Fire Stopping
- Section 01 91 01 or 01 91 02 Commissioning Process

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

Abbreviations of standards organizations referenced in this and other sections are as follows:

AGA	American Gas Association
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASPE	American society of Plumbing Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
CGA	Compressed Gas Association
CS	Commercial Standards, Products Standards Sections, Office of Engineering Standards Service, NBS
EPA	Environmental Protection Agency
FM	FM Global
	FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
IAPMO	International Association of Plumbing & Mechanical Officials

IEEE	DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
DSPS	State of Wisconsin Dept. of Safety and Professional Services
MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
STI	Steel Tank Institute
UL	Underwriters Laboratories Inc.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

CONTINUITY OF EXISTING SERVICES

Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.
DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION PROTECTION OF FINISHED SURFACES

Refer to Division 1, General Requirements, Protection of Finished Surfaces.

SLEEVES AND OPENINGS

Refer to Division 1, General Requirements, Sleeves and Openings.

SEALING AND FIRESTOPPING

Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with section 07 84 00 Fire Stopping.

CODES

Comply with requirements of NFPA Standards and local Fire Chief or Fire Marshal (AHJ, Authority Having Jurisdiction) regarding design, materials and installation.

DESIGN CRITERIA

Design fire protection systems in accordance with codes, standards and regulations noted above.

Hydraulically design system for the most remote area based on the following:

		Area	Density	,
Location	Occupancy Classification	(Sql	t)	(GPM/SqFt)
Storage B29	Storage Group S	650	0.2	

Remote area increase for drypipe/preaction systems and other circumstances i.e. sloped or higher ceilings are to be added to the minimum remote areas noted above as required by code. Remote area reduction for use of quick response sprinkler heads is not allowed without prior approval of the A/E.

DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION Provide a Class 1, automatic wet standpipe system for this facility.

Contractor is responsible for obtaining water supply test data from the water supplier or Fire Department for use in system design. Preferred hydrant locations are with the non-flowing hydrant upstream of the building lateral and the flowing hydrant downstream. Flows should be at least what is required for design sprinkler and hose demand. This may require one or both hydrant outlets or more than one hydrant be opened. Preferred test time is during high water use periods.

CERTIFICATES AND INSPECTIONS

Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer. Include copies of the certificates and reports in the Operating and Maintenance Instructions.

SUBMITTALS

Refer to Section GC - General Conditions of the Contract, Submittals.

Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

The specific items that will be required for submittals shall be coordinated with the A/E, and the General Prime Contractor for inclusion in the project submittal log.

Plan submittal for review and approval to the Department of Safety and Professional services is required for all state buildings with the exception of the replacement in kind of equipment and projects that include 20 or fewer sprinkler heads. Licensed health care facilities require submittal and approval from the

Department of Health Services. Submittals shall be sent to the local Fire Chief or Fire Marshal for review prior to the Architect/Engineer. Include a copy of all review/approval letters in submission to Architect/Engineer.

Submit plans indicating water supply location and size, piping layout and size, sprinkler locations and type, hanger locations and type, equipment locations and type, valve locations and type, occupancy classes, hydraulic reference points, design areas and discharge densities.

Submit hydraulic calculations for water supply and sprinkler and standpipe systems. Include summary sheet and detailed work sheets. Describe characteristics of water supply and location of effective point used in calculations. Include graph illustration of water supply, hose demand, sprinkler demand and inrack sprinkler demand. Where a fire pump is used, graph primary rating point, secondary rating point and churn pressure of pump and combined water supply.

Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:

Dperating and Maintenance Manuals	2 copies
	Dperating and Maintenance Manuals

- Architect/Engineer 1 copy
- Local Fire Chief or Marshal 1 copy

OPERATING AND MAINTENANCE INSTRUCTIONS

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

TRAINING OF OWNER PERSONNEL

Instruct Owner's personnel in the proper operation, maintenance and testing of systems and equipment provided as part of this project. Include not less than _____ hours of instruction, using the Operating and Maintenance manuals and record drawings during this instruction. Demonstrate testing, startup and shutdown procedures for all equipment. All training to be during normal working hours.

RECORD DOCUMENTS

Refer to Division 1, General Requirements, Record Documents.

In addition to the data indicated in the General Requirements, maintain fire protection layout record drawings and hydraulic calculations on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings and calculations with the Operating and Maintenance manuals.

PART 2-PRODUCTS

ACCESS PANELS AND DOORS

LAY-IN CEILINGS:

Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 09 are sufficient; no additional access provisions are required unless specifically indicated.

CONCEALED SPLINE CEILINGS:

Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Division 09.

METAL PAN CEILINGS:

Removable sections of ceiling tile held in position by a pressure fit will be provided under Division 09.

MASONRY WALLS, GYPSUM BOARD AND PLASTER WALLS AND CEILINGS:

16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

IDENTIFICATION

STENCILS:

Not less than 1/2" high letters for pipe sizes 1" through 2-1/2" and 1" high letters/numbers for pipe sizes 3" and above for marking pipe and equipment. Apply flow arrows to piping.

ADHESIVE LABELS:

Pressure-sensitive, adhesive backed, vinyl pipe markers with applicable labeling, ¾" min. size for lettering and surrounding tape on both ends. With flow arrows on piping. Conforming to ANSI, ANSI and NFPA standards. Seton Opti-Code, MSI, Brady or approved equal. Clean piping before application.

SNAP-AROUND MARKERS:

One-piece, pre-formed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling, $\frac{3}{4}$ " min. size for lettering. Provide nylon ties on each end of pipe marker. Seton Setmark or approved equal.

SIGNS:

Metal construction, baked porcelain enamel finish signs, sizes conforming to NFPA no. 13 and 7-1.2, with holes and s-hooks/chains for hanging or securing. With applicable labeling. MSI, Seton, W.H. Brady or equal.

ENGRAVED NAME PLATES:

White letters on a black background, 1/16" thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or equal by W. H. Brady.

VALVE TAGS:

Round brass tags with 1/2" numbers, 1/4" system identification abbreviation, 1-1/4" minimum diameter, with brass jack chains with brass "S" hooks or one piece nylon ties around the valve stem, available from EMED Co., Seton Name Plate Company, MSI or W. H. Brady.

SEALING AND FIRE STOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with section 07 84 00 "Fire Stopping".

NON-RATED PENETRATIONS:

Pipe Penetrations Through Below Grade Walls:

In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the building interior.

Pipe Penetrations:

At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required, use urethane caulk in annular space between pipe insulation and wall material.

PART 3-EXECUTION

DEMOLITION

Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the User Agency to minimize disruption to the existing building occupants.

All pipe, sprinklers, equipment, wiring, associated conduit and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the User Agency/Owner for his use at a place and time he so designates. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION CONCRETE WORK

Cast-in-place concrete within the building will be performed by the Division 3 Contractor. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of plumbing piping, fixtures, specialties and equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3 Contractor.

CUTTING AND PATCHING

Refer to Division 1, General Requirements, Cutting and Patching.

BUILDING ACCESS

Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

EQUIPMENT ACCESS

Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Prime Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Fire Protection Contractor and installed by the General Prime Contractor.

Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

COORDINATION

Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION IDENTIFICATION

Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion.

Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

Identify interior piping mains not less than once every 25 feet, not less than once in each room, adjacent to each access door or panel, and on both sides of the partition where exposed piping passes through walls or floors. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background, or approved pipe marking label systems, or provide snap-around type pipe markers as specified in Part 2 – Products.

Identify valves with signs per NFPA rulings.

Provide hydraulic design information sign of permanently marked weatherproof metal or engraved nameplate material. Secure to alarm valve with brass chain. Information to include location of the design areas, discharge densities, required flow and residual pressure at the base of riser, hose stream demand and sprinkler demand.

LUBRICATION

Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

SLEEVES AND OPENINGS

Pipe penetrations in new poured concrete horizontal construction requiring F and T rating: Form opening using hole form or core drill opening. Alternatively provide cast in place fire stopping devices/sleeves.

Pipe penetrations in new poured concrete horizontal construction requiring F rating but no T rating: Same as pipe penetrations in new poured concrete construction requiring F and T ratings except that schedule 40 steel sleeves may also be used.

Pipe penetrations in new poured concrete horizontal construction that do not require F or T ratings: Provide schedule 40 steel pipe sleeve, form opening using hole form or core drill opening.

Pipe penetrations in existing concrete floors: Core drill openings.

Pipe penetrations through existing floors located in food service areas that do not require a T rating: Core drill sleeve opening large enough to insert schedule 40 sleeve, extend sleeve 2 inches above the floor and grout area around sleeve with hydraulic setting, non-shrink grout. Size sleeve to allow insulated pipe to run through sleeve and paint the sleeve.

Where penetrating pipe or conduit weight is supported by floor, provide manufactured product or structural bearing collar designed to carry load.

SEALING AND FIRE STOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with section 07 84 00 Fire Stopping.

NON-RATED PARTITIONS:

In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions. The bolt heads for the mechanical seal shall face the inside of the building to facilitate repair or replacement of the seal.

At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

DOCUMENT 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION PENETRATIONS SUBJECT TO WATER INTRUSION:

For penetrations (both rated and non-rated) in floors subject to water intrusion or in rooms housing electrical equipment (but not within walls) provide one of the following:

- Pipe penetration where steel pipe sleeve is used extend steel sleeve 2" above the floor.
- Pipe penetration where cast in place fire stopping device/sleeve is used, extend device/sleeve 2" above the floor (provided it meets the device's UL listing).
- Pipe penetration where there is no steel sleeve or cast in place fire stopping device/sleeve, provide 2"x 2" x 1/8" galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water from getting to penetration. Provide urethane caulk between angles and floor and fasten angles to floor minimum 8" on center. Seal corners water tight with urethane caulk.

Floors subject to water intrusion or rooms housing electrical equipment include the following locations:

- Food Service/Kitchen Areas
- Walk In Coolers/Freezers
- Laundries
- Restrooms
- Locker/Shower Rooms
- Janitor Rooms w/ Sinks
- Wet Laboratories
- Mechanical/Plumbing Equipment Rooms
- Swimming Pool Rooms/Pool Equipment Rooms
- Chemical/Hazardous Waste Storage
- Maintenance/Industrial Shops
- Vehicle Storage and Parking Ramps
- Greenhouses
- Data/Telecommunications Rooms
- Electrical Equipment Rooms

Provide waterproof caulk sealant top coating on fire stopping system (or other approved means to protect the fire stopping system from water) in areas subject to wash down such as Food Service and Dish Washing Areas.

OWNER TRAINING

All training provided for Owner shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF DOCUMENT 21 05 00

PART 1 - GENERAL

SCOPE

This section contains specifications for fire suppression pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL Scope Related Work Reference **Reference Standards Shop Drawings** Quality Assurance Delivery, Storage, and Handling Design Criteria Welder Qualifications PART 2 - PRODUCTS Fire suppression Piping Unions and Flanges Mechanical Grooved Pipe Connections Sprinkler Heads Flexible Sprinkler Drop Fittings Flow Switches **Pressure Switches** Local Alarm **Pressure Gauges** Valves Specialty Valves Hose Outlet Valves Fire Hoses Fire Department Connection Fire Pump Test Connection Air Compressor PART 3 – EXECUTION General Preparation Erection **Copper Pipe Joints** Welded Pipe Joints Threaded Pipe Joints Mechanical Grooved Pipe Connections Unions and Flanges Piping System Leak Tests Underground Water Main Flushing Installation **Construction Verification Items**

RELATED WORK

Section 01 91 01 or 01 91 02 - Commissioning Process

Section 21 08 00 – Commissioning of Fire Suppression

Section 21 05 00 – Common Work Results for Fire Suppression

Section 21 05 29 – Hangers and Supports for Fire Suppression Piping and Equipment

Section 21 30 00 – Fire Pumps

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI A21.4

ANSI A21.11

- ANSI A21.51
- ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings
- ANSI B16.3 Malleable and Ductile Iron Threaded Fittings
- ANSI B16.4 Cast Iron Threaded Fittings
- ANSI B16.5 Pipe Flanges and Flanged Fittings
- ANSI B16.9 Factory Made Wrought Steel Buttweld Fittings
- ANSI B16.11 Forged Steel Fittings, Socket Welded and Threaded
- ANSI B16.18 Cast Bronze Solder Joint Pressure Fittings
- ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
- ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings -DWV
- ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
- ASTM A105 Forgings, Carbon Steel, for Piping Components
- ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
- ASTM A135 Electric Resistance Welded Steel Pipe
- ASTM A181 Forgings, Carbon Steel for General Purpose Piping
- ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
- ASTM A536 Ductile Iron Castings
- ASTM A795 Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
- ASTM B88 Seamless Copper Water Tube
- AWS A5.8 Brazing Filler Metal
- AWS D10.9 Qualification of Welding Procedures and Welders for Piping and Tubing, Level AR3
- NFPA 13 Installation of Sprinkler Systems. (Latest prevailing edition)
- NFPA 14 Installation of Standpipe and Hose Systems. (Latest prevailing edition)
- UL Underwriters' Laboratories Listing
- FM Factory Mutual Approval

SHOP DRAWINGS

Schedule from the contractor indicating the ANSI/ASTM specification number of the pipe being proposed along with its type and grade, if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

Order steel pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping systems for the highest pressures and temperatures in the respective system but not less than 175 psig.

Where weld fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where mechanical grooved fittings are used, use only ASTM standard radius fittings, short radius grooved fittings are not allowed.

Where ASTM A53 or A795 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where ASTM A135 grade A pipe is specified, grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS

Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and

Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping. The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the Owner's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

PART 2 - PRODUCTS

FIRE SUPPRESSION PIPING STEEL PIPE: Black steel pipe welded and seamless, Type F, Grade A, ASTM A53; black welded and seamless steel pipe for fire protection use, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.

Pipe wall Thickness: Threaded pipe shall have a minimum wall thickness of schedule 40. All other pipe shall have a minimum wall thickness of schedule 10. Piping 2" and under shall be minimum schedule 40 unless stated otherwise herein.

Fittings: Cast iron threaded fittings, Class 125 or 250, ASTM A126/ANSI B16.4. Malleable and ductile iron threaded fittings, Class 150 or 300, ASTM A197/ANSI B16.3. Standard weight seamless carbon steel weld fittings, ASTM A234 grade, ANSI B16.9. Mechanical grooved fittings with EPDM gaskets, ASTM A536 ductile iron, ASTM A47 malleable iron or ASTM A53 fabricated steel. For wet pipe systems mechanical tee fittings with full iron back equal to Grinnell Figure 730 will be allowed only as needed for connection to existing systems. Outlets for drypipe and preaction systems shall be mechanical tees. Mechanical tees with U-bolt back or other fastening means are not allowed.

Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

Finish: Hot dipped zinc coated (galvanized) finish on piping and fittings shall be used in drypipe and pre-action systems, piping exposed to weather and piping exposed to corrosive environments where indicated. Thread or grooved hot dipped zinc coated pipe ends for fitting connections. Indoor dry standpipe systems supplied by a Fire Dept. connection only may be black steel piping and fittings.

CPVC PIPE:

CPVC Sprinkler Pipe, ASTM F 442, SDR 13.5. 1" through 2" pipe size only. CPVC Sprinkler Fittings, Schedule 40 and Schedule 80 dimensions for 1" through 1-1/4", Schedule 80 for 1-1/2" through 2". Products to be UL Listed/FM Approved for a rated working pressure of 175 psi at 150°F for sprinkler service. Spears FlameGuard or BlazeMaster.

No exposed CPVC piping material is allowed.

Plastic pipe and fittings will not be allowed for this project.

PRESSURE SENSING LINE PIPE:

Seamless Red Brass pipe, ASTM 43, regular weight (Schedule 40), with ASTM B584 threaded copper alloy pressure fittings,

Type L copper water tube, H (drawn) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, lead free (<.2%) solder, ASTM B32; flux, ANSI B16.22; copper phosphorous brazing alloy, AWS A5.8 BCuP.

UNIONS AND FLANGES

2" AND SMALLER STEEL:

ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Grooved couplings may be used in lieu of unions.

2" AND SMALLER COPPER: ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

2-1/2" AND LARGER:

ASTM A181 or A105, Class 150, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. ANSI B16.1 or ANSI B16.5, Class 150 cast iron threaded flanges. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

2-1/2" AND LARGER COPPER:

ANSI B16.24, Class 150 cast bronze flanges with raised face.

MECHANICAL GROOVED PIPE CONNECTIONS

Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Anvil, or Grinnell may be used with steel pipe. Mechanical grooved components and assemblies to be rated for minimum 175 psi working pressure unless noted otherwise.

All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters shall be from the same manufacturer.

Couplings and fittings to be malleable iron, ASTM A47, or ductile iron A536 with painted finish. Fittings used on galvanized steel pipe to have galvanized finish, ASTM A153.

Gaskets to be EPDM, ASTM D2000. Gaskets for dry systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A-183, with zinc electroplated finish.

Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

Credit for the inherent flexibility of mechanical grooved pipe connections when used for expansion joints or flexible connectors may be allowed upon specific application by the Contractor. Three flexible couplings at first three connection points both upstream and downstream of pumps may be used in lieu of flexible connectors. Request for expansion joints shall be made in writing and shall include service, location, line size, proposed application and supporting calculations for the intended service.

SPRINKLER HEADS

Manufacturer: Sprinkler head model numbers establish type and style of head. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted: Tyco, Reliable, Victaulic, Viking and Globe.

Standard coverage sprinkler heads are to be the basis for design unless noted otherwise on the plans or within these specifications.

Fusible link or glass bulb type, cast brass or bronze construction. Provide heads with nominal 1/2" or 17/32" discharge orifice except where greater than normal density requires large orifice.

Select fusible link or glass bulb temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide ordinary temperature (155 to 165 degree) fusible link or glass bulb type except at skylights, sealed display windows, unventilated attics and roof spaces, over cooking equipment, adjacent to diffusers, unit heaters, uninsulated heating pipes or ducts, mechanical rooms, storage rooms, or where otherwise indicated.

Provide quantity of spare heads as noted below and 1 wrench for each type of head and each temperature range installed. Provide 6 spare heads per 300 or less installed heads, 12 per 1000 or less and 24 for more than 1000. Provide steel cabinet for storage of heads and wrenches. Provide an equal number of concealed cover plates and/or sprinkler escutcheons for each spare sprinkler head.

Quick Response Upright: Viking Microfast M (QR), brass finish.

Quick Response Vertical Sidewall: Viking Microfast M, chrome finish.

Quick Response Pendant: Viking Microfast M, chrome plated finish and escutcheon.

Quick Response Sidewall: Viking Microfast M, chrome plated finish and escutcheon.

Dry Pendant (Self-contained type): Viking Model C, brass finish with brass escutcheon.

Dry Pendant (Self-contained type): Viking Model M (Quick Response), adjustable, recessed, with chrome escutcheon.

Dry Horizontal Sidewall (Self-contained type): Viking Model M (Quick response), adjustable, recessed, with chrome escutcheon.

Concealed sprinkler: Viking Mirage (Quick Response), with adjustable concealed cover plate. Cover plate finish to be selected by the Architect/Engineer from the manufacturer's standard finish selections.

Pendant Security: Tyco Raven, Security pendent shall not have an exposed heat sensing element.

Horizontal Sidewall Security: Tyco Raven, with sleeve, centering grommet and retainer flange. Security sidewall shall not have an exposed heat sensing element.

FLEXIBLE SPRINKLER DROP FITTINGS

Manufacturers: FlexHead Industries, Victaulic or Viking.

Corrugated Type 304 stainless steel hose with braided Type 304 stainless steel exterior cover, welded stainless steel or zinc plated steel inlet and outlet threaded fittings with EPDM seals. 175 PSI pressure rating. 225 °F temperature rating, 1" minimum internal hose diameter. 40" maximum hose length, straight or angle outlet configuration. Galvanized steel ceiling support bar and brackets selected to match project ceiling support system requirements. UL Listed and FM approved.

Flexible drops are only allowed for use above fully accessible ACT ceilings.

FLOW SWITCHES

Vane type waterflow switch with metal enclosure, adjustable pneumatic retard and electrical characteristics compatible with alarm system.

PRESSURE SWITCHES

Pressure actuated switch with field adjustable settings, metal enclosure and electrical characteristics compatible with alarm system.

LOCAL ALARM

Weatherproof electric horn/strobe with red painted metal housing, mounting base and weatherproof gasket seal, and electrical characteristics compatible with alarm system. The horn strobe should be mounted above or as close as possible to the fire department connection.

PRESSURE GAUGES

Manufacturer: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.

Cast aluminum, stainless steel, brass, polycarbonate or ABS case of not less than 3.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale. Include bronze 3-way globe valve with plugged outlet for Fire Inspector's test gauge.

VALVES

Manufacturers: Kennedy, Milwaukee, Nibco, Stockham, Victaulic, or Watts.

BALL VALVES:

2" and smaller: Bronze, 2-piece, threaded or sweat ends, standard port, blowout proof stem, chrome plated ball, glass reinforced seats, UL approved @ 250 psi. Watts No. B-6000 UL.

GATE VALVES:

2" and smaller: Outside screw and yoke gate valves, 175 psig, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.

2-1/2" and larger: Outside screw and yoke gate valves, 175 psig, cast iron body, bronze mounted, bolted bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.

BUTTERFLY VALVES:

2" and smaller: Bronze body butterfly valve, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, Buna or Viton seat, stainless steel disc and stem.

2" and larger: Cast or ductile iron body butterfly valve, lug style or grooved, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, EPDM resilient seat, EPDM seals, nickel plated ductile iron disc. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use cap screws for removal of downstream piping while using the valve for system shutoff.

SUPERVISORY/TAMPER SWITCHES:

For O S & Y valve or butterfly valve installations, UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

CHECK VALVES:

3" and smaller: Bronze body, threaded end, Y-pattern, regrindable bronze seat, renewable bronze disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.

2-1/2" and larger: Cast or ductile iron body, flanged or grooved ends, bronze trim, bolted cap, renewable bronze seat and disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.

Provide 1/2" automatic drip drain on inlet of fire dept. connection check valve.

SPRING LOADED CHECK VALVES:

2" and smaller: Bronze body, threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, 175 psig, teflon seat unless only bronze available.

2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, 175 psig.

DRAIN VALVES:

3/4" minimum, two piece bronze body ball valve; threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG, with hose thread outlet and cap.

DOUBLE CHECK VALVES:

Manufacturers: Ames, Conbraco, Febco, Watts, or Wilkins.

ASSE 1015 _" double check backflow preventer with 2 independent spring loaded swing type check valves, 2 isolation butterfly or gate valves with normally open tamper switch with double wire leads, 4 valved test ports. Size for minimum pressure drop. Constructed of bronze or epoxy coated cast/ductile iron or stainless steel body with bronze and plastic internal parts, stainless steel springs, silicone rubber valve discs, bronze seats, rated for 175 psig.

SPECIALTY VALVES

Manufacturer: Tyco, Reliable, Victaulic, Viking and Globe.

DRY PIPE VALVES:

Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal, single hitch pin and latch design. Provide trim for air supply, drain, priming level, alarm connections, pressure gages, priming chamber attachment, ball drip valves, drip cup assembly piped to floor or hub drain, fill line attachment with strainer.

AIR PRESSURE MAINTENANCE DEVICE:

Automatic control capable of maintaining system air pressure, rated for 175 psig, adjustable air pressure range of 15 to 60 psig, complete with isolation valves, bypass fill valve, pressure regulator or pressure switch and strainer.

DELUGE/PREACTION VALVES:

Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal. Provide trim for bypass, drain, electric sprinkler alarm switch, pressure gages, drip cup assembly piped to floor or hub drain, fill line attachment with strainer and push rod chamber assembly. Include dry pilot trim consisting of actuator, air and water pressure gages, low air warning switch, air relief valve and diaphragm actuation device with replaceable bronze seat and resilient diaphragm.

DELUGE/PREACTION CONTROL:

Single areatype in NEMA 1 enclosure with detector, alarm, power supply, battery charger, standby battery, electrically supervised solenoid valves, polarized fire alarm, lamp test, wiring terminal strip, auxiliary alarm contacts.

HOSE OUTLET VALVES

Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, Potter-Roemer, or Guardian.

CLASS I AND CLASS III SYSTEMS:

2-1/2" brass angle valve, 300 psig, with removable red handwheel, 2-1/2"x1-1/2" reducing lug pin connector coupling and National Standard male hose thread outlet, cap and chain. Provide N.P.T. female outlet where hose is required.

FIRE HOSES

Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, Potter-Roemer, or Guardian.

100' long, 1-1/2" synthetic lined and jacketed collapsible hose, 500 lb. test, with satin brass nipple and pin lug coupling, satin brass adjustable spray fog nozzle. Provide pivoting red painted steel hose rack with hose pins and collar to secure to hose outlet valve.

FIRE DEPARTMENT CONNECTION

Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, J.W. Moon, Potter-Roemer, and W.D. ALLEN

EXPOSED:

Polished cast brass exposed fire department inlet, two-way inlet body, swing clappers, pin-lug swivels and plugs with chains, 2-1/2" National Standard female hose thread inlets, 6"outlet, cast brass lettered identification backplate.

FLUSH:

Polished cast brass or ductile iron flush fire department inlet, two-way inlet body, swing clappers, pin-lug swivels and caps with chains, 2-1/2" National Standard female hose thread inlets, 6" outlet, cast brass lettered identification backplate.

FIRE PUMP TEST CONNECTION

Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, J.W. Moon, Potter-Roemer, and W.D. ALLEN

FLUSH:

Polished cast brass or ductile iron flush fire pump test connection outlet, two-way outlet body, male snoots, pin-lug caps with chains, removable swivel hose gate valves with 2-1/2" National Standard male hose thread outlets, 4" inlet, cast brass lettered identification backplate.

AIR COMPRESSOR

Manufacturer: Quincy, Ingersoll Rand, Nash, and Viking.

Multi-Zone and large systems: Simplex electric motor belt driven oil lubricated compressor mounted on ASME rated galvanized receiver tank, pressure operated electric switch, motor, magnetic motor starter with three phase overload protection, fused disconnect switch, safety relief valve, check valve, shutoff valve, pressure gauge, automatic tank drain, intake mufflerfilter, belt guard and adjustable operating pressure control.

Single zone and small systems: Riser pipe mounted air compressor installation. Electric motor driven, air cooled, oil-less, adjustable, single stage compressor. With check valve, pressure switch, pressure relief valve, mounting bracket kit and air filter assembly. Equal to Viking model E-1.

PART 3 - EXECUTION

GENERAL

Install pipe fittings, and other fire suppression system components in accordance with reference standards, manufacturers recommendations and recognized industry practices.

PREPARATION

Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

ERECTION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of fire protection piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, ceiling grid layout, light fixtures and grilles before installing piping.

Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

Provide 3/32" min. thickness steel nailing plates behind or on either side of piping where the possibility of penetration from nails or drywall screws exists.

Maintain piping in clean condition internally during construction.

Provide clearance for access to valves and piping specialties.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Install piping so that system can be drained. Where possible, slope to main drain valve. Slope dry pipe and pre-action systems subject to freezing at minimum 1/4"/10' on mains and 1/2"/10' on branches. Where piping not susceptible to freezing cannot be fully drained, install nipple and cap for drainage of less than 5 gallons or ball valve with hose thread outlet and cap for drainage over 5 gallons. Pipe main drain valve to grade or to air gap sewer receptor.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

Do not route piping within exterior walls.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all

equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

COPPER PIPE JOINTS

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation and assemble joint to socket stop. Apply flame to fitting until brazing alloy melts when placed at joint. Wipe excess alloy from joint.

WELDED PIPE JOINTS

Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used up to following sizes:

Maximum	
Weldolet/	Main
Threadolet	Pipe
Diameter	Diameter
3/4"	11/4"
1"	11/2"
11/4"	2"
11/2"	2½"
2"	3"
3"	4"
4"	6"
6"	8"

THREADED PIPE JOINTS

Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

MECHANICAL GROOVED PIPE CONNECTIONS

Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools available for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

UNIONS AND FLANGES

Install a union, flange or grooved coupling combination at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union or grooved coupling combination connections on the equipment side of the valve. Concealed unions, flanges or couplings are not acceptable.

FLEXIBLE SPRINKLER DROP FITTINGS

Install in accordance with manufacturer's installation instructions following minimum bend radii, maximum number of bends and bend distance from end requirements.

PIPING SYSTEM LEAK TESTS

Conduct pressure test with test medium of water. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

Test piping in sections or entire system as required by sequence of construction. Do not conceal pipe until it has been successfully tested. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Entire test must be witnessed by the Division's representative.

Use clean water and remove air from the piping being tested where possible. Measure and record test pressure at the high point in the system.

Test system at 200 psi for 2 hours showing no leakage. Where system design is in excess of 150 psig, test at a pressure 50 psig above system design pressure.

All pressure tests are to be documented on NFPA Contractor's Material and Test Certificate forms.

UNDERGROUND WATER MAIN FLUSHING

Conduct flushing of the underground water/fire main service as required by NFPA 13. The 200 PSI pressure test of the main shall be conducted by the installer of the main. The flushing operation is to be documented on NFPA Underground Contractor's Material and Test Certificate forms.

INSTALLATION

Install fire protection system components in accordance with NFPA rulings, listings and manufacturers recommendations. Locate where accessible for servicing and replacement.

Sprinkler Heads: Locate sprinkler heads as indicated on fire protection plan and reflected ceiling plan maintaining minimum clearances from obstructions, ceilings and walls. Install sprinkler heads level in locations not subject to spray pattern interference. Provide fire sprinkler head installations below ductwork, soffits, etc.

Switches: Locate flow and pressure switches where indicated and where required to obtain specified zoning to isolate floors and major areas of floors. Provide valved test connection for flow switch adjacent to flow switch. Pipe to floor drain. Test flow switch to verify proper operation.

Gauges: Provide a valved pressure gauge in main fire protection riser, at the top of each piping riser, at inlet and outlet of pump and elsewhere as indicated.

Valves: Properly align piping before installation of valves. Do not support weight of piping system on valve ends. Mount valves in locations which allow access for operation, servicing and replacement. Install all valves with the stem in the upright or horizontal position. Valves installed with the stems down will not be accepted. Provide a riser shutoff valve and a capped hose thread

drain valve at the bottom of each riser. Provide capped hose thread drain valves to allow draining of each portion of piping.

Specialty Valves: Install in vertical position fire protection riser. Install trim recommended by manufacturer including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms, pressure maintenance devices, emergency pull boxes and deluge/preaction controls.

Hose Outlet Valves: Install at each standpipe outlet and elsewhere where indicated approximately 4' above floor.

Fire Department and Fire Pump Test Connections: Mount on wall where indicated. Support from structure independent of piping. Locate between 2' to 3' above grade. Fill wall penetration with insulation and caulk exterior and interior face of wall opening weathertight.

Air Compressor: Install on concrete housekeeping pad, leveled and bolted in place. Pipe automatic drain discharge piping to floor drain. Install line size ball valve and check valve in discharge line. Install pressure gauge upstream of ball valve.

CONSTRUCTION VERIFICATION ITEMS Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 21 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF DOCUMENT 21 10 00

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. General Plumbing Requirements specifically applicable to all Division 22 Sections.
 - 2. Some piping material and installation instructions common to most piping systems.
 - 3. Grout.
 - 4. Plumbing Demolition (when indicated on the drawings).
 - 5. Equipment installation requirements common to equipment sections.
 - 6. Concrete bases.
 - 7. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene monomer rubber.

COMMON WORK RESULTS FOR PLUMBING

2. NBR: Acrylonitrile-butadiene rubber.

1.4 REFERENCES AND STANDARDS:

- A. The latest editions recognized of the following are hereby included in and made a part of Division 22:
 - 1. NFPA National Fire Protection Association
 - 2. UL Underwriters' Laboratories, Inc.
 - 3. NEMA National Electrical Manufacturer's Association
 - 4. NEC National Electric Code
 - 5. ASME American Society of Mechanical Engineers
 - 6. AWS American Welding Society
 - 7. ANSI American National Standards Institute
 - 8. AGA American Gas Association
 - 9. HI Hydronics Institute
 - 10. OSHA Occupational Safety and Health Act
 - 11. AWWA American Water Works Association
 - 12. CISPI Cast Iron Soil Pipe Institute

1.5 QUALITY ASSURANCE AND COORDINATION

- A. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- B. All work to meet in-force local plumbing code. In the case of discrepancies between the project contract documents and the in-force local code, the most stringent shall govern.
- C. As NU FMO plumbing staff shall walk through and inspect all plumbing work prior to walls or ceilings being closed up, deficiencies shall be noted and given to the project manager in writing. D. Comply with most current edition of Northwestern University Design Standards.
- E. All materials and installations shall meet applicable FM Global requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Contractor shall coordinate the work of the different trades so that interference between piping, equipment, structural, and electrical work will be avoided. All necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work properly shall be furnished complete in place at no additional cost.
- B. Unless otherwise stipulated under a particular heading, the following rules relative to responsibilities of the Contractors and Subcontractors will apply:
 - 1. Make-up water piping connections shall be provided by the Plumbing Contractor to within five (5) feet of the required point of connection to the equipment and there terminated with a shut-off valve. Each trade shall make the final connection to the equipment it installs.
 - 2. Ceiling access panels will be installed by the General Contractor at locations determined by the Plumbing Contractor.
 - 3. The Plumbing Contractor or subcontractor shall install all roughing-in pertaining to his trade for each item of equipment furnished under another Section of the Specifications or by the Owner.
 - 4. The Plumbing Contractor shall make final connections of equipment to rough-ins.

1.8 EQUIPMENT START-UP

A. Start-up of all plumbing equipment shall be video-recorded by the plumbing contractor. Two DVD copies shall be turned over to the Owner's maintenance staff.

1.9 TESTING AND REPAIR

- A. All piping and ductwork systems shall be thoroughly cleaned and flushed prior to final testing.
- B. Pressure testing shall be completed for the following piping systems:

- 1. Domestic water, sanitary and vent, storm and gas piping systems, and other systems as noted on the plans.
- C. All testing must be witnessed and accurately recorded noting methods of testing, times, dates, and results.
- D. Any damage as a result of tests shall be repaired or damaged materials replaced at no cost to the Owner.

1.10 FINAL COMPLETION

- A. All work shall be cleaned prior to issuance of Substantial Completion.
- B. Retouch or repaint factory painted prime and finish coats where scratched or damaged.
- C. Deliver any equipment as required by this Specification to Owner and obtained signed receipts of delivery.
- D. Clean equipment, restore damaged materials, and leave the Work in acceptable condition.
- E. Remove all site tools, equipment, surplus materials and rubbish continuously at no additional cost to the Owner.
- F. Contractor shall submit written certificates warranting each item of equipment.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS:

- A. All equipment and materials shall be furnished in strict accordance with the equipment named and according to Specification requirements. Each bid shall be based upon one of the materials or manufacturers specified.
- B. Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.
- C. Where multiple manufacturers are named the drawings and specifications are based on the requirements and layouts for the equipment of the first named manufacturer. Any change required by the use of other named manufacturers such as revisions to foundations, bases, piping, controls, wiring, openings, and appurtenances shall be made by the Contractor at no additional cost to the Owner.

2.2 PIPE, TUBE, AND FITTINGS - GENERAL

- A. Refer to individual Division 22 Piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

- 1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
- 2. Design Mix: 5000-psi, 28-day compressive strength.
- 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION (When indicated on the drawings)

- A. Refer to applicable Division 01 Section covering cutting and patching and applicable Division 02 Section covering selective structure demolition for general demolition requirements and procedures.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- C. All unused waste, water and vent that is no longer in service shall be removed from ceilings, walls and floors. No dead piping will be allowed to stay. Underground piping shall also be removed. If piping cannot be removed underground it shall be capped at the main and the pipe shall be pumped and filled with a flowable fill.
- D. A MOP will be required when filling abandoned sewers, old water mains or any plumbing piping that is buried in the ground.
- E. Before abandoning any plumbing piping underground, the piping shall be inspected, video recorded, mapped on an as built and FMDC and FMO shall approve abandoning the piping.

F. After completion of of all work, all of the sewer systems involved with the project in their entirety, shall be thoroughly cleaned out to remove all grit, or other foreign matter. This shall include the use of a camera and recording to a flash drive or DVD and a copy of the recording included with the close out documents.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. All materials and/or equipment shall be installed per manufacturer's recommendations and instructions.
- B. When temporary water is required, an approved backflow device shall be used and testing reports from device shall be sent to FMO plumbing foreman for verification.
- C. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- D. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- E. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Piping shall not project beyond walls or steel lines nor shall it hang below slabs more than is absolutely necessary. Particular attention shall be paid to the required clearances.
- H. Offset piping where required to avoid interference with other work, to provide greater headroom or clearance, or to conceal pipe more readily. Offsets shall be properly drained or trapped where necessary.
- I. Provide swing joints and expansion bends wherever required to allow the piping to expand without undue stress to connections or equipment.
- J. Exposed piping around fixtures or in other conspicuous places shall not show tool marks at fittings.

- K. Isolate pipe from the building construction to prevent transmission of vibration to the structure and to eliminate noise.
- L. Install piping such that any equipment connected to piping may be removed by disconnecting two (2) flanges or unions and removing only one or two pipe sections. All equipment shall have bolted or screwed flanges or unions at pipe connections.
- M. Install fittings for changes in direction and branch connections. T-drill system for mechanically formed tee connections and couplings, and Victaulic hole cut piping system are not allowed.
- N. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.
- O. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- P. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- Q. Install piping to permit valve servicing.
- R. Install piping at indicated slopes.
- S. Install piping free of sags and bends.
- T. Install piping to allow application of insulation.
- U. Eccentric reducing couplings shall be provided in all cases where air or water pockets would otherwise occur due to a reduction in pipe size.
- V. Cap and plug all openings in pipes during construction with suitable metal plugs or cap to keep out dirt and rubbish until equipment is connected.
- W. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- X. Select system components with pressure rating equal to or greater than system operating pressure.

- Y. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Z. Verify final equipment locations for roughing-in.
- AA. Refer to equipment specifications in other Sections of these Specifications for roughingin requirements.
- BB. Provide proper access to materials and equipment that require inspection, repair, service, or maintenance.
- CC. Minimum service access size for materials equipment/components above ceilings shall be 24" square.
- 3.3 PIPING JOINT CONSTRUCTION
 - A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
 - B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 PIPING CONNECTIONS

A. Pipe sizes indicated shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within one foot of the equipment. At temperature control valves with sizes smaller than connected lines, reduction shall be made immediately adjacent to valves.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install Plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Install dowel rods to connect concrete base to concrete floor.
 - 2. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete"

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor Plumbing materials and equipment. C. Field Welding: Comply with AWS D1.1.
- 3.8 GROUTING
 - A. Mix and install grout for Plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
 - B. Clean surfaces that will come into contact with grout.
 - C. Provide forms as required for placement of grout.
 - D. Avoid air entrapment during placement of grout. E. Place grout, completely filling equipment bases.
 - F. Place grout on concrete bases and provide smooth bearing surface for equipment.
 - G. Place grout around anchors.
 - H. Cure placed grout.

END OF DOCUMENT 22 00 00

DOCUMENT 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductileiron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- 2.2 STACK-SLEEVE FITTINGS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Smith, Jay R. Mfg. Co.
 - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
 - B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe.

Include type and number required for pipe material and size of pipe.

- 2. Pressure Plates: Carbon steel or stainless steel.
- 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.
- 2.5 GROUT
 - A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
 - B. Characteristics: Nonshrink; recommended for interior and exterior applications.
 - C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

- 3.1 SLEEVE INSTALLATION
 - A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
 - B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
 - C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

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- 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall. C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than [NPS 6 (DN 150)]: Cast-iron wall sleeves or galvanized-steelpipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves or galvanizedsteelpipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system or galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

- b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system or galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller than NPS 6 (DN 150): Cast-iron floor sleeves with sleeve-seal system, galvanized-steel-pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron floor sleeves with sleeve-seal system, galvanized-steel-pipe sleeves with sleeve-seal system, or galvanizedsteel-pipe sleeves.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6 (DN 150) : Galvanized-steel-pipe sleeves, stacksleeve fittings, or Sleeve-seal fittings.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves or stacksleeve fittings.
- 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF DOCUMENT 22 05 17

DOCUMENT 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

ESCUTCHEONS FOR PLUMBING PIPING

DOCUMENT 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or splitcasting brass type with polished, chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

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- 1. New Piping: One-piece, floor-plate type.
- 2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF DOCUMENT 22 05 18

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.
 - 2. Bronze swing check valves.
 - 3. Iron swing check valves.
 - 4. Iron swing check valves with closure control.
 - 5. Bronze globe valves.
 - 6. Iron globe valves.
 - 7. Chainwheels. B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.
- C. To assure uniformity and compatibility, all grooved end valves and adjoining couplings shall be supplied by the same manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 4. Chainwheel: Device for attachment to valve handwheel, stem, or other

actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article. E. Valves in Insulated Piping: With 2-1/4 inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material,

and protective sleeve that allows operation of valve without breaking the vapor seal or

disturbing insulation. F. Valve-End Connections:

- 1. Flanged: With flanges according to ASME B16.1 for iron valves.
- 2. Solder Joint: With sockets according to ASME B16.18.
- 3. Threaded: With threads according to ASME B1.20.1.
- 4. Grooved: With grooves according to ANSI/AWWA C606.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Ball Valves with Stainless-Steel Trim:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)

- 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: 316 Stainless Steel.
 - i. Ball: 316 Stainless Steel.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.4 IRON SWING CHECK VALVES

- A. Class 125, Iron Swing Check Valves with Metal Seats:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)
 - 2. Description:
 - a. Standard: MSS SP-71, Type I.

GENERAL-DUTY VALVES FOR PLUMBING PIPING

- b. CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

2.5 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

- 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
 - h. Closure Control: Factory-installed, exterior lever and spring.

2.6 BRONZE GLOBE VALVES

- A. Class 125, Bronze Globe Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron.

2.7 IRON GLOBE VALVES

- A. Class 125, Iron Globe Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc. (Apollo)
 - 2. Description:
 - a. Standard: MSS SP-85, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Packing and Gasket: Asbestos free.

2.8 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

- 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
- 2. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating.
- 3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

F. Install grooved end valves in accordance with the manufacturer's guidelines and recommendations. A representative shall provide on-site training for contractor's field personnel in the installation of grooved end valves. Factorytrained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball valves.
 - 2. Throttling Service: Globe or ball valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valveend option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valveend option is indicated in valve schedules below.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valveend option is indicated in valve schedules below.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE

SCHEDULE A. Pipe NPS 2 and Smaller:

- 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
- 2. Bronze Angle Valves: Class 125, bronze disc.
- 3. Ball Valves: Two piece, full port, 316 stainless steel with bronze trim.
- 4. Bronze Swing Check Valves: Class 125, bronze disc.
- 5. Bronze Globe Valves: Class 125, bronze disc. B. Pipe NPS 2-1/2 and

Larger:

- 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
- 2. Iron Swing Check Valves: Class 125, metal seats.
- 3. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
- 4. Iron Globe Valves: Class 125.

END OF DOCUMENT 22 05 23

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Pipe positioning systems.
 - 8. Equipment supports. B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
 - 3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

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- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Pipe stands.
 - 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel. B.

Stainless-Steel Pipe Hangers and Supports:

- 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
- 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
- 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel. C.

Copper Pipe Hangers:

- 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
- 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and Ubolts.

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT 22 05 29 - 3

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Powerstrut
 - d. Unistrut Corporation; Tyco International, Ltd.
 - 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - 3. Standard: MFMA-4.
 - 4. Channels: Continuous slotted steel channel with inturned lips.
 - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washers made of carbon steel.
 - 7. Metallic Coating: Electroplated zinc or mill galvanized.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carpenter & Paterson, Inc.
 - 2. Clement Support Services.
 - 3. ERICO International Corporation.
 - 4. National Pipe Hanger Corporation.
 - 5. PHS Industries, Inc.
 - 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 - 7. Piping Technology & Products, Inc.
 - 8. Rilco Manufacturing Co., Inc.
 - 9. Value Engineered Products, Inc.

- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862kPa) minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa), ASTM C 552, Type II cellular glass with 100-psig (688-kPa), or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration. D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Stainless steel.

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- 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuousthread rods.
- 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainlesssteel, roller-type pipe support. E. High-Type, Multiple-Pipe Stand:
- 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
- 2. Bases: One or more; plastic.
- 3. Vertical Members: Two or more protective-coated-steel channels.
- 4. Horizontal Member: Protective-coated-steel channel.
- 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structuralsteel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbonsteel shapes.

2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

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PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. F. Pipe Stand Installation:

- 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
- 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

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- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. 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.
- M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

- 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
- 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

- a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution 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 weightdistribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
- 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
- 5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicateinsulation inserts of length at least as long as protective shield.
- 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

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3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in applicable Division 9 section(s).
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

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- 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
- 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
- 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
- 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
- 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
- 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
- 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
- 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
- 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
- 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
- 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
- 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
- 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbonsteel plate, and with U-bolt to retain pipe.
- 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

- Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
- 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
- Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
- 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- L. 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.

- M. 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 barjoist 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 Ibeams for heavy loads.
 - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams 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.

- N. 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.
- O. 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 11/4 inches (32 mm).
 - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 - 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 - 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 - 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.

- c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF DOCUMENT 22 0529

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Valve tags.
 - 4. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 WORK INCLUDED

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT 22 05 53 - 1

- A. Furnish and install nameplates, valve tags, valve charts, and pipe markers on all Plumbing equipment, and piping.
- B. Provide nameplates with the unit number and service designation on all plumbing equipment.
- C. Indicate all valve tag numbers on Record Drawings and submit framed under glass valve tag charts including valve service and location.
- D. Install color coded ceiling tacks in acoustical tile ceilings or color coded tape on ceiling grid to identify location of equipment, valves and dampers that require regular maintenance or are part of a life safety system (fire dampers, smoke dampers, sprinkler valves or main isolation valves). Concealed fire protection valves shall be marked by red label triangles (3" equilateral) and circle dots (1" diameter). Triangles shall be placed on the wall nearest the valve with the apex pointing toward the ceiling tile. Dots shall be placed on border of ceiling tile.
- E. Provide underground plastic pipe markers 6 to 8 inches below finish grade, directly above buried pipes.
- F. Prepare valve charts and frame under glass. All valves and the tag numbers shall be shown on the Record As-Built Drawings.
- G. Provide valve computer data base to match chart.
- H. Prepare and install exterior protected brass plaques indicating underground service entrances.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable manufactures contingent on compliance with the specification.

- 1. Seton
- 2. Brady Corporation
- 3. Marking Services Incorporated

2.2 EQUIPMENT NAMEPLATES

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT 22 05 53 - 2

- A. Equipment nameplates shall be 3" x 6" long, 0.02" aluminum with a black enamel background with engraved natural aluminum letters similar to Seton Style 2065-20. Nameplate shall have pressure sensitive taped backing.
- B. The nameplate shall contain the unit or equipment designation ("AHU" for air handling unit, "P" for circulating pump, etc.), unit number and area or system served.
- C. Nameplates for exterior equipment shall be applied with waterproof adhesive.

2.3 PIPE IDENTIFICATION AND VALVE TAGS

- A. All piping, except that piping which is within inaccessible chases, shall be identified with semirigid plastic identification markers equal to Seton Setmark pipe markers.
 - 1. Direction of flow arrows are to be included on each marker.
 - 2. Each marker background shall be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems" (ASME A13.1-1981).
 - 3. Setmark snap-around markers shall be used for overall diameters up to 6" and straparound markers shall be used above 6" overall diameters.
 - 4. Markers shall be located:
 - a. Adjacent to each valve
 - b. At each branch
 - c. At each cap for future
 - d. At each riser takeoff,
 - e. At each pipe passage through wall (each side)
 - f. At each pipe passage at 20' 0" intervals maximum.
 - g. At each piece of equipment.
 - h. At all access doors.
 - i. A minimum of one (1) marker shall be provided at each room.
 - 5. Under ground pipe markers:
 - a. Provide detectable tape on all underground piping:
 - b. Labels shall be color coded and labeled the same as indoors.
- B. Valve tags

- 1. All valves shall be designated by distinguishing numbers and letters carefully coordinated with a valve chart. Valve tags shall include what room(s) the valve serves and piece of equipment served.
- 2. Valve tags shall be color coded 0.032" anodized aluminum tags, with engraved letters similar to Seton S Type 250-BL or approved equal.
 - a. HVAC tags shall be round 2" diameter, similar to Seton 15426.
 - b. Plumbing tags shall be square 2" x 2" similar to Seton 42769.
 - c. Fire Protection tags shall be square 2" x 2" similar to Seton 42769 RED.
 - d. Lettering shall be ¹/₄" high for type service and ¹/₂" for valve number. Tag shall indicate service and valve number.
 - e. Each service shall be a different color.
- 3. Tag shall be attached to valves with chain similar to Seton No 16 stainless steel jack chain.
- 4. Whenever a valve is above a hung ceiling, the valve tag shall be located immediately above the hung ceiling.
- 5. Provide a tag for every valve except:
 - a. Perimeter radiation shut-off valves that are located at the finned tube radiation element within the accessible (from the space) heating enclosure
- C. Furnish a minimum of two (2) typed valve lists
 - 1. Each framed under glass or Plexiglas. Each chart shall be enclosed in an approved 0.015" thick plastic closure for permanent protection.
 - 2. Valve numbers shall correspond to those indicated on the Record Drawings and on the printed valve lists.
 - 3. The printed list shall include the valve number, location and purpose of each valve.
 - 4. It shall state other necessary information such as the required opening or closing of another valve when one valve is to be opened or closed.
 - 5. Printed framed valve lists shall be displayed in each Mechanical Room or in a location designated by Northwestern University.
- D. Valve data base.
 - 1. Provide a valve data base for all valves to operate on the building computer.
 - 2. Every valve shall include:
 - a. Tag Number

- b. Service (Hot water, Chilled water, Sprinkler, etc.)
- c. Size
- d. Operation
- e. Location
- f. Manufacture
- g. Model number
- h. Submittal reference

2.4 UTILITY ENTRANCE DESIGNATIONS

A. Provide a brass wall plaque, minimum 0.020" thickness, secured to the exterior wall just above the grade line for all buried service entrances or exits. Samples are: Water Service Below; Gas Service Below; Sanitary Sewer Below; Storm Sewer Below; Irrigation Water Below; etc. B. Ceiling Tacks or Tape.

- C. Provide steel color coded 3/4 inch diameter ceiling tacks in acoustical tile ceilings or color coded tape applied to ceiling grid to locate equipment, valves or dampers that require regular maintenance or are part of a Life Safety System.
- D. The tacks or tapes shall be color codes as follows:
 - 1. Yellow HVAC
 - 2. Red Life Safety (fire dampers, sprinkler valves, etc.)
 - 3. Green Plumbing Valves.
 - 4. Blue Heating/Cooling Valves.

PART 3 - EXECUTION

3.1 PREPARATION

- A. All surfaces shall be cleaned and insulated (if applicable) prior to installing any identification.
- B. Exterior surfaces of outdoor equipment shall be dry and prepared to accept the specified identification.

3.2 INSTALLATION
DOCUMENT 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion. Seal with clear lacquer. B. Install valve tags with chain.

- C. Install plastic pipe markers in accordance with manufacturer's Instructions.
- D. Install plastic tape markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify air handling units, pumps, domestic hot water heaters, fire pumps, heat transfer equipment tanks, water treatment devices, etc. with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Install detector tape on all under ground services in accordance with the manufactures recommendations.
- I. Identify thermostats relating to air handling equipment serving multiple spaces.
- J. Identify valves in main and branch piping with valve tags.
- K. Tag automatic controls, instruments and relays. Key to control schematic.
- L. Identify piping, concealed or exposed, with pipe markers or where buried using plastic tape pipe markers. Use tags on piping ³/₄ inch diameter and smaller. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF DOCUMENT 22 0553

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.

Insulation Materials:

- a. Flexible elastomeric.
- b. Mineral fiber.
- c. Polyolefin.
- 2. Insulating cements.
- 3. Adhesives.
- 4. Mastics.
- 5. Sealants.
- 6. Factory-applied jackets.
- 7. Field-applied fabric-reinforcing mesh.
- 8. Field-applied jackets.
- 9. Tapes.
- 10. Securements.
- 11. Corner angles.
- B. Related Sections include the following:
 - 1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed

statement of VOC content. C. Shop Drawings:

- 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
- 2. Detail attachment and covering of heat tracing inside insulation.
- 3. Detail insulation application at pipe expansion joints for each type of insulation.
- 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
- 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
- 6. Detail application of field-applied jackets.
- Detail application at linkages of control devices. 8. Detail field application for each equipment type. D. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-testresponse characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smokedeveloped index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smokedeveloped index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Aeroflex USA Inc.; Aerocel.
- b. Armacell LLC; AP Armaflex.
- c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000 Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factoryapplied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:PLUMBING INSULATION22 07 00 - 3

- a. Armacell LLC; Tubolit.
- b. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.
- c. RBX Corporation; Therma-cell.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Aeroflex USA Inc.; Aeroseal.
- b. Armacell LCC; 520 Adhesive.
- c. Foster Products Corporation, H. B. Fuller Company; 85-75.
- d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-82.
- b. Foster Products Corporation, H. B. Fuller Company; 85-20.

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- c. ITW TACC, Division of Illinois Tool Works; S-90/80.
- d. Marathon Industries, Inc.; 225.
- e. Mon-Eco Industries, Inc.; 22-25.
- 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Chemical Company (The); 739, Dow Silicone.
- b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
- c. P.I.C. Plastics, Inc.; Welding Adhesive.
- d. Speedline Corporation; Speedline Vinyl Adhesive.
- 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

- 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-10.
- b. Foster Products Corporation, H. B. Fuller Company; 35-00.
- c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
- d. Marathon Industries, Inc.; 550.
- e. Mon-Eco Industries, Inc.; 55-50.
- 2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 200 deg F.
- 4. Solids Content: 63 percent by volume and 73 percent by weight.
- 5. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.
 - 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 - 4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

- a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 - 5. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products: Subject to compliance with requirements, provide one of the

following:

1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.

- 2. Adhesive: As recommended by jacket material manufacturer.
- 3. Color: White.
- 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

- 2. Width: 3 inches.
- 3. Thickness: 6.5 mils.
- 4. Adhesion: 90 ounces force/inch in width.
- 5. Elongation: 2 percent.
- 6. Tensile Strength: 40 lbf/inch in width.
- 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 - 2. Width: 2 inches.
 - 3. Thickness: 6 mils.
 - 4. Adhesion: 64 ounces force/inch in width.
 - 5. Elongation: 500 percent.
 - 6. Tensile Strength: 18 lbf/inch in width.
- D. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
 - 2. Width: 3 inches.
 - 3. Film Thickness: 4 mils.
 - 4. Adhesive Thickness: 1.5 mils.
 - 5. Elongation at Break: 145 percent.
 - 6. Tensile Strength: 55 lbf/inch in width.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.

- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

- 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
- 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fireresistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles. B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

- 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
- 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

- 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
- 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
- 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
- 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

- 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
- 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainlesssteel or aluminum bands. Select band material compatible with insulation and jacket.
- 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
- 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
- 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to

eliminate openings in insulation that allow passage of air to surface being insulated. B.

Insulation Installation on Pipe Flanges:

- 1. Install pipe insulation to outer diameter of pipe flange.
- 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
- 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
- 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface

being insulated. C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. D. Insulation Installation on Valves and Pipe Specialties:

- 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
- 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- 3. Install insulation to flanges as specified for flange insulation application.
- 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant. B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

- Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant. C. Insulation Installation on Pipe Fittings and Elbows:
- 1. Install preformed sections of same material as straight segments of pipe insulation when available.
- 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.7 POLYOLEFIN INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.

- 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of polyolefin pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. D. Insulation Installation on Valves and Pipe Specialties:
- 1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
- 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- 3. Install insulation to flanges as specified for flange insulation application.
- 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- D. Where PVDC jackets are indicated, install as follows:
 - 1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 - 2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 - 3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 - 4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit

allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.9 FINISHES

- A. Equipment and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.

- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, locations of welded strainers, locations of threaded valves, and locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE PLUMBING INSULATION

22 07 00 - 21

- A. Domestic Cold and Non-potable Cold Water: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1/2 inch thick for pipe sizes less than 1-1/2 inches, 1 inch thick for pipe sizes 2 inches and greater
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick for pipe sizes less than 1-
 - 1/2 inches, 1 inch thick for pipe sizes 2 inches and greater
 - 3. Polyolefin: 1/2 inch thick for pipe sizes less than 1-1/2 inches, 1 inch thick for pipe sizes 2 inches and greater
- B. Domestic Hot, and Re-circulated Hot Water and Tempered Water: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 3. Polyolefin: 1 inch thick.

C. Horizontal Stormwater and Emergency Drain: Insulation shall be one of the following:

- 1. Flexible Elastomeric: 1 inch thick.
- 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- 3. Polyolefin: 1 inch thick.

D. Roof Drain and Emergency Drain Bodies: Insulation shall be one of the following:

- 1. Flexible Elastomeric: 1 inch thick.
- 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch Insert thickness thick.
- 3. Polyolefin: 1 inch thick.
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops at lavatories shall be insulated and finished with Truebro Model No. 102 "Lav-Guard" or Brocar "Trap-Wrap" white insulation kit.
- F. Sanitary Waste Piping Where Heat Tracing Is Installed, insulation shall be:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Domestic Cold, Hot, and Recirculated Hot Water: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 2 inches thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
- B. Sanitary Waste Piping Where Heat Tracing Is Installed: Insulation shall be:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the fieldapplied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. PVC: 20 mils thick.
- 3.15 Aluminum, Smooth or Corrugated or Stucco Embossed: 0.016 inch thick.

END OF DOCUMENT 22 07 00

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DOCUMENT 22 07 00 - PLUMBING INSULATION

DOCUMENT 22 11 13 – WATER SERVICE LINES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General
- B. Protection
- C. Testing
- D. Cleanup

1.2 RELATED SECTIONS

- A. Section 31 20 00 Earth Moving
- B. Section 32 91 13 Site Restoration

1.3 QUALITY ASSURANCE

A. The Contractor shall perform Work in accordance with the Rules and Regulations of Selma Water Works and Sewer Board (SWWS), Alabama, and other governing authorities.

- B. The plumbing contractor must be a master plumber currently licensed with the City of Selma, Alabama.
- C. The Contractor shall obtain materials from the same source throughout.

PART 2 - PRODUCTS

2.1 PRODUCT STORAGE, HANDLING, AND MATERIALS

- A. The Contractor shall be responsible for storing materials, pipes, fittings, and other accessories until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free of dirt at all times.
- B. All the materials, pipes, fittings, backflow preventors, meters, meter boxes but not limited to, shall meet requirements of SWWS.
- C. The Contractor shall obtain the list of approved manufactures from the SWWS for all the material and products to be used in the project.
- D. Copper tubing Type "K" or brass laterals is allowed with either flared or threaded brass fittings.

DOCUMENT 22 11 13 – WATER SERVICE LINES

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall coordinate all construction work with **SWWS** prior to beginning of construction.
- B. The Contractor shall control traffic in accordance with all the ALDOT Traffic Regulation when necessary.
- C. The Contractor shall be responsible for all the excavation, safety, and backfilling.
- D. Backfilling shall be in accordance with Document 30 20 00 Earth Moving.
- E. All activities shall be performed in accordance with the manufacturers' recommendations, regulations established by OSHA, AWWA & SWWS.
- F. The Contractor shall identify the locations of all underground utilities prior to commencing excavation activities. The Contractor shall consult with utility companies to verify the locations of underground utilities.
- G. The Contractor shall notify the SWWS promptly if a water or sanitary line or any part of water or sanitary line is damaged, broken, or disturbed. The contractor shall replace or repair damages and restore the service at his own expense to the satisfaction of SWWS.
- H. The Contractor shall obtain approval from the Engineer and the utility owner prior to performing any temporary or permanent repairs, or relocation of utilities.
- I. The number of joints in the water service line shall be kept to a minimum.
- J. The Contractor is responsible for all water usage resulting from his negligence and/or oversight during the construction work.
- K. The Contractor shall be familiar with the SWWS standards and specifications.

3.2 TESTING

- A. All water lines shall be disinfected and hydrostatically tested in accordance with SWWS requirements.
- B. All pipe joints shall be as near watertight as it is practical to construct them with the material and methods specified.
- C. If tests indicate that Work does not meet specified requirements, the Contractor shall remove Work, replace, and retest at no cost to the Owner.
- D. The Contractor shall not cover any defective work or a portion of any defective work. If any defective work is covered, the contractor shall expose the defective work at his own expense.

DOCUMENT 22 11 13 – WATER SERVICE LINES

3.3 CLEANUP

A. After completing the construction, the Contractor shall remove all debris and construction materials and equipment from the site; grade and smooth over the surface on both sides of line; and leave the entire construction area in a clean, neat, and serviceable condition. The Contractor shall restore the site to the original or better condition in accordance with requirements of Document 32 91 13 - Site Restoration.

END OF DOCUMENT 22 11 13

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. Under-building slab supply, and aboveground domestic water supply and recirculation pipes, tubes, fittings, and certain specialties inside the building from 1'-0" above finished floor or 1'-0" inside the exterior wall as shown on the drawings, and as coordinated with the related work of Division 33.
- 2. Flexible connectors.
- 3. Piping encasement.
- 4. Water meters.
- 5. Application of valves. B. Related Sections:
- 1. Division 33 Section "Facility Water Distribution Piping" for water-service piping outside the building from the source to a point 1'-0" above finished floor or 1'-0" inside the exterior wall of the building as shown on the drawings.
- 2. Division 22 0523 "General Duty Valves for Plumbing Piping"
- 3. Section 22 0000 "Common Work Results of Plumbing."
- 4. Section 22 2114 "Plumbing Specialties."
- 5. Section 22 4000 "Plumbing Fixtures."
- 6. Section 22 4500 "Plumbing Equipment."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. *[LEED Submittal:*

1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.]

C. Field quality-control reports.

- D. For any systems requiring State code pre-approval, provide letters from the State for same.
- E. Documentation that proposed products meet California Health and Safety Code 116875 (AB 1953) - 2010, for 25% low lead content of piping, pipe fittings, and faucets for water intended for human consumption.
- F. At closeout, Northwestern University Maintenance Requirement Forms, see Division 01 for more information.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with California Health and Safety Code 116875 (AB 1953) 2010, for 25% low lead content of piping, pipe fittings, and faucets for water intended for human consumption, and NSF/ANSI Standard 61, including Annex G-2010 Drinking Water System Components Low Lead Content Requirement.
- C. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by the same manufacturer.
- D. All grooved couplings shall be installed strictly according to grooved manufacturer's instructions including torque verification and specific lubrication as published.
- E. Flexible connectors shall be installed according to the manufacturer's instructions, with any adjacent special pipe support/guiding required.
- F. Comply with FM Global requirements for cross connections, and for any pressure reducing valves for fire protection service.

1.5 SPECIAL WARRANTIES

A. Five (5) years, see Division 01 for more information.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

- 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
- 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ballandsocket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- 5. Grooved-End Copper Fittings: ASTM B 75 copper tube, or ASTM B 152 wrought copper, with copper tubing sized grooved ends designed to accept grooved couplings. Flaring of tube and fitting ends to IPS dimensions is not permitted.
- 6. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile- iron housing with keys matching pipe and fitting grooves: 2" through 8": Installation ready rigid coupling with Grade EHP/EPDM gaskets (unless noted otherwise herein) rated for maximum 250 deg F for use with housing, and steel bolts and nuts. Victaulic Style 607.
- 7. Grooved-End-Tube Mechanical Tube Fittings: Copper-tube dimensions and design similar to AWWA C606. Bronze upper housing and copper-colored enamel coated ductile iron lower housing, threaded outlet and locating collar, EPDM synthetic rubber gasket suit able for hot and cold water, and bolts and nuts. Victaulic Style 622.

2.3 DUCTILE-IRON PIPE AND FITTINGS (For 3" and Larger Pipe

- Sizes) A. Mechanical-Joint, Ductile-Iron Pipe:
 - 1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Standard-Pattern, Mechanical-Joint Fittings:

- 1. AWWA C110/A21.10, ductile or gray iron.
- 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Compact-Pattern, Mechanical-Joint Fittings:
 - 1. AWWA C153/A21.53, ductile iron.
 - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.
- 2.4 GALVANIZED STEEL PIPE AND FITTINGS (Only for Limited Repair of Existing Galvanized Sections, and Joint Types and Supports to Match Adjacent Existing Similar Piping, and 6" and larger sizes only).
 - A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Standard Weight. Include ends matching existing joining method(s).
 - 1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe.
 - 2. Galvanized, Gray-Iron Fittings: ASME B16.4, Class 125, standard pattern.
 - 3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with balland-socket, metal-to-metal, with bronze seating surfaces.
 - 4. Flanges: ASME B16.1, Class 125, cast iron.
- 2.5 PIPING JOINING MATERIALS
 - A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
 - B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
 - C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813. Shall be Lead free NSF/ANSI 61 compliant.

- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for generalduty brazing unless otherwise indicated. Shall be Lead free NSF/ANSI 61 compliant. E. Flux: ASTM B 813, water flushable.
- F. Pipe Thread Tape: Food grade commercial duty pipe thread sealant tape only.

2.6 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Flanges:
 - 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous;

threaded solderjoint copper alloy and threaded ferrous. C. Dielectric-Flange Kits:

- 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.

e. Washers: Phenolic with steel backing washers. D. Dielectric

Couplings:

- 1. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic. E. Dielectric

Nipples:

- 1. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.8 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
 - 2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainlesssteel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
 - 2. End Connections NPS 2 (DN 50) and Smaller: Threaded stainless steel pipe nipple.
 - 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged stainless steel pipe nipple.

- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flex-Hose.
 - 2. Flexicraft.
 - 3. Hyspan.
 - 4. Flex Precision.

2.9 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: [Sheet] [or] [tube].
- C. Color: [Black] [or] [natural] <Insert color>.

2.10 WATER METERS

A. Water meter type to be as indicated on the drawings, and they must meet University and local water purveyor requirements. B. Turbine-Type Water Meters:

- 1. Description:
 - a. Standard: AWWA C701.
 - b. Pressure Rating: 150-psig working pressure.
 - c. Body Design: Turbine; totalization meter.
 - d. Registration: In gallons or cubic feet as required by utility company
 - e. Case: Bronze.
 - f. End Connections for Meters NPS 2 and Smaller: Threaded.
 - g. End Connections for Meters NPS 2-1/2 and Larger: Flanged.
 - h. For vertical or horizontal mounting. C. Compound-Type

Water Meters:

- 1. Description:
 - a. Standard: AWWA C702.
 - b. Pressure Rating: 150-psig working pressure.
 - c. Body Design: With integral mainline and bypass meters; totalization meter.

- d. Registration: In gallons or cubic feet as required by utility company.
- e. Case: Bronze.
- f. Pipe Connections: Flanged.

D. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company, and by University.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 2000 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping and related components. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook" and no joints allowed under slabs.
- C. The maximum developed length of 1/2" diameter piping shall be 10'.
- D. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- E. Install underground [copper tube] [and] [ductile-iron pipe] in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- F. No joints or fittings in lines below floors after the facility water entry assembly. *G.* Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in
Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Plumbing Specialties" for drain valves and strainers.

- H. Install shutoff valve immediately upstream of each dielectric fitting.
- I. Install domestic water piping level and plumb.
- J. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping adjacent to equipment and specialties to allow service and maintenance.
- O. Install piping to permit valve servicing.
- P. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
 Q. Install piping free of sags and bends.
- R. Install fittings for changes in direction and branch connections.
- S. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- T. Provide proper access to components and work that require inspection, repair, service, or maintenance.
- U. No piping with a fluid shall be routed over electrical busway housings. For electrical busway housings, provide a minimum 36" inches on top, both sides, and the bottom.

- V. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- W. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- X. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- Y. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."
- Z. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter. Shall be Lead free NSF/ANSI 61 compliant.

- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook." Shall be Lead free NSF/ANSI 61 compliant.
- F. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- G. Joint Construction for Grooved-End, Ductile-Iron Piping: Make radius cut joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- J. Grooved Joints for Copper Piping: Roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. A representative shall provide on-site training for contractor's field personnel. Contractor shall remove and replace any improperly installed products.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations. Shall be Lead free NSF/ANSI 61 compliant.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use OS&Y or NRS 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. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.
- E. For isolation valves at water heaters, install valves that relieve heater pressure when closed.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition [fittings] [or] [unions].
- C. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing. Shall be Lead free NSF/ANSI 61 compliant.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump. B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in non-copper domestic water piping.

3.8 WATER METER INSTALLATION

- A. Rough-in domestic water piping, and install water meter as indicated on the drawings according to AWWA M6 and the utility company's requirements.
- B. Install water meters with shutoff valves on water-meter inlet and outlet. Provide a valved bypass around meter only if required by the utility company. Support meters, valves, and piping on brick or concrete piers.
- C. Install remote registration system according to standards of University, utility company, and of authorities having jurisdiction.

3.9 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers. B. Support vertical

piping and tubing at base and at each floor.

- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. 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: 96 inches with 3/8-inch rod.
- 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
- 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- 6. NPS 6: 10 feet with 5/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install hangers for ductile iron 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: 12 feet with 3/4-inch rod.
 - 4. NPS 8 and Larger: 12 feet with 3/4-inch rod.
- G. Install supports for vertical ductile iron piping every 15 feet.

3.10 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 water-service piping at a point 1'-0" above finished floor or 1'0" inside the exterior wall, as shown on the drawings, with a shutoff valve using a transition fitting to join dissimilar piping materials then extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet 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. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 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.

3.11 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section"Identification for Plumbing Piping and Equipment" for identification materials and installation. B. Label pressure piping with system operating pressure.

3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction, FMDC and FMO.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, minimum of 100 psi, without exceeding pressure rating of piping system materials.

Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

- 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
- 6. Prepare reports for tests and for corrective action required.
- D. Domestic piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.13 ADJUSTING

A. Perform the following adjustments before operation:

- 1. Close drain valves, hydrants, and hose bibbs.
- 2. Open shutoff valves to fully open position.
- 3. Open throttling valves to proper setting.
- 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
- 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
- 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
- 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.14 CLEANING

- A. Clean and disinfect potable domestic water piping as follows (and in accordance with local code and jurisdiction):
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

- 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction.
 Repeat procedures if biological examination shows contamination. B.
 Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.15 PIPING SCHEDULE

- 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 and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water piping, NPS 2 1/2 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; no joints allowed under floor slabs.

D. Under-building-slab, domestic water piping, NPS 3 and larger, shall be the following:

1. Ductile Iron; with ductile iron fittings, and mechanical joints.

- E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper solder-joint fittings; and soldered joints. Shall be Lead Free NSF/ANSI 61 compliant.
- F. Aboveground domestic water piping, NPS 2 1/2, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper braze joint fittings; and brazed joints. Shall be Lead Free NSF/ANSI 61 compliant.
 - 2. Hard copper tube, ASTM B 88, Type L; grooved, with matching fittings; and roll grooved joints. Shall be Lead Free NSF/ANSI 61 compliant.
- G. Aboveground domestic water piping, NPS 3 and 4, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper braze-joint fittings; and brazed joints. Shall be Lead Free NSF/ANSI 61 compliant.
 - 2. Hard copper tube, ASTM B 88, Type L; grooved, with matching fittings; and roll grooved joints. Shall be Lead Free NSF/ANSI 61 compliant.
 - 3. Ductile Iron; with ductile iron fittings, and mechanical or grooved joints. Shall be Lead Free NSF/ANSI 61 compliant.
- H. Aboveground domestic water piping, NPS 6 and Larger, shall be the following:
 - 1. Ductile Iron; with ductile iron fittings, and mechanical or grooved joints.
 - 2. Galvanized pipe with mechanical joints.
- 3.16 VALVE SCHEDULE (Including Access to Same)
 - A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use OS&Y or NRS gate valves or ball valves with flanged ends for piping NPS 2-1/2 and larger (ball valves only to 3"). Shall be Lead Free NSF/ANSI 61 compliant.
 - 2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Shall be Lead Free NSF/ANSI 61 compliant.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
 - 4. Drain Duty: Hose-end drain valves. Shall be Lead Free NSF/ANSI 61 compliant.

- 5. Faucets and fixtures, such as emergency showers, eyewashes, dishwashers, and autoclaves, shall have local shutoff valves within 5' of the faucet/fixture. Valves must be readily accessible. Shall be Lead Free NSF/ANSI 61 compliant.
- 6. Shut-off isolation valves shall be provided on the branch lines no more than 18" off of the main lines or risers. Additional shut-off isolation valves may be needed further down the branch lines also, and are to be provided to the satisfaction of the University. Shall be Lead Free NSF/ANSI 61 compliant.
- B. Iron grooved-end valves may be used with grooved-end piping. Shall be Lead Free NSF/ANSI 61 compliant.
- C. Access panels shall be provided for any plumbing valves that may be in walls or inaccessible ceilings. Access panels shall be a minimum of 12" x 12".

END OF DOCUMENT 22 11 18

DOCUMENT 22 13 13 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General
- B. Cleanup

1.2 RELATED SECTIONS

- A. Section 31 20 00 Earth Moving
- B. Selection 32 91 13 Site Restoration

PART 2 - PRODUCTS

- 2.1 GENERAL
 - A. All materials and products shall be in accordance with the Selma Water Works and Sanitary Sewer Board (SWWS) standards.
 - B. The sanitary sewer service pipe shall be ductile iron pipe class 350.
 - C. Cleanouts shall be installed within thirty inches of the building and at least once on each continuous run on 75' and at each change in horizontal or vertical direction greater than 45 degrees.

PART 3 - EXECUTION

- 3.1 GENERAL
 - A. The Contractor shall identify the locations of all underground utilities prior to commencing excavation activities. The Contractor shall consult with utility companies to verify the locations of underground utilities.
 - B. The Contractor shall obtain a Sanitary Sewer Impact Permit from the SWWS before starting any work
 - C. All the construction material, construction operations, and testing on the sanitary sewer service line shall be in accordance with the SWWS.
 - D. The Contractor shall coordinate all construction works with the SWWS.

3.2 TESTING AND BACKFILLING AFTER CONSTRUCTION

- A. The service line shall pass required tests as per **SWWS** standards.
- B. All tests and the backfilling shall be approved by the SWWS Sewer Service Inspector.

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- C. The Contractor shall not backfill a failed service line or a portion of a failed service line. If any part of a failed service line has been covered, the plumbing contractor shall uncover the pipe for necessary inspections at his own risk and expense.
- D. If tests indicate that Work does not meet specified requirements, the Contractor shall remove Work, replace, and retest at no cost to the Owner.

3.3 CLEANUP

A. Restore the site as per the Section 32 91 13 - Site Restoration.

END OF DOCUMENT 22 13 13

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 sanitary drainage inside the building up to a point 5'-0" outside the building and vent piping inside the building including:
 - 1. Pipe and fittings.
 - 2. Special pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

- A. LEED Submittal:
 - 1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
- B. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- 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; and "NSF-drain" for plastic drain piping.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify the University no fewer than seven days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without the University's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosionresistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve. C.
 Schedule 40 PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 - 1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
 - 2. Pressure Fittings:
 - Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with balland-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
 - e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- E. CPVC Drainage Pipe and Fittings: ASTM F 2618 pipe and drainage-pattern fittings.
 - 1. Acceptable Manufacturers: Charlotte Chemdrain (Basis of Design)
 - 2. Solvent Cement for Joining CPVC Piping: ASTM F 493. Include primer according to ASTM F 656.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil & waste piping shall be:
 - 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
- D. Aboveground, vent piping shall be one of the following:
 - 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. E.

Underground, soil, waste, and vent piping shall be one of the following:

- 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
- 2. Solid-wall Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
- F. Sewage pump or sump pump discharge piping shall be one of the following:
 - 1. Solid-wall Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. Schedule 40 galvanized steel pipe with screwed galvanized cat iron drainage fittings.
- G. Single-Wall, Chemical-Waste Sewerage Piping: Use the following piping materials for each size range:
 - 1. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): CPVC drainage pipe and fittings and solventcemented joints.
- H. Underground, Double-Containment, Chemical-Waste Sewerage Piping: Use the following piping materials for each size range:
 - 1. NPS 2 to NPS 12 (DN 50 to DN 300): CPVC double-containment drainage pipe and fittings.

- I. Aboveground Chemical-Waste Piping: Use the following piping materials for each size range:
 - 1. NPS 1-1/2 to NPS 6 (DN 40 to DN 150): CPVC drainage piping and solventcemented joints.
- J. PVC piping may **not** be installed in a return air plenum for any of the above piping applications unless piping is completely insulated in fire retardant insulation rated for return air plenums.

3.3 PIPING INSTALLATION

- A. Site sanitary sewer piping to a point 5'-0" outside the building is specified in Division 33 Section "Facility Sanitary Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. 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."
- D. Install CPVC drainage piping according to ASTM D 2321 and ASTM F 1668.
- E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- F. 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.

- G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Sanitary Drains: 2 percent downward in direction of flow for piping NPS 2 and 1 percent downward in direction of flow for piping NPS 3 and larger.
 - 2. Vent Piping: Slope toward vertical fixture vent or toward vent stack.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Install PVC soil and waste drainage and vent piping according to ASTM D 2665 and ASTM D 2321.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing".
- L. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing".
- M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing".

3.4 VALVE INSTALLATION

- A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump or sump pump discharge.
- C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump or sump pump discharge.

3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- 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. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls.
 - Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Install piping hangers and rod diameters per MSS-SP-69 E. Install supports for

vertical cast-iron soil piping every 15 feet.

F. Install supports for vertical steel piping every 15 feet.

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- G. Install supports for vertical CPVC piping every 48 inches.
- H. Install supports for vertical PVC piping every 48 inches.
- I. Support piping and tubing according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. 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 "Sanitary Waste Piping Specialties."
 - 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 "Sanitary Waste Piping Specialties."
 - 4. Equipment: Connect drainage piping or pump discharge 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.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures. Inspections shall be made by FMO plumbing staff prior to closing-in of walls.
 - 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 piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Test Procedure: Test 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.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 **PROTECTION**

A. Exposed PVC Piping: Protect PVC piping exposed to sunlight with two coats of waterbased latex paint.

END OF DOCUMENT 22 13 16

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DOCUMENT 22 13 16 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

- 1. Cleanouts.
- 2. Floor drains.
- 3. Through penetration firestop assemblies.
- 4. Roof flashing assemblies.
- 5. Miscellaneous sanitary drainage piping specialties.
- 6. Flashing materials.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

- 2.1 CLEANOUTS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company. SANITARY WASTE PIPING SPECIALTIES

- 2. Smith, Jay R. Mfg. Co.
- 3. Tyler Pipe; Wade Div.
- 4. Zurn Plumbing Products Group. B. Exposed Horizontal Cleanouts, **CO**:
- 1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
- 2. Size: Same as connected drainage piping
- 3. Body Material: Hubless, cast-iron soil pipe test tee as required matching connected piping.
- C. Floor Cleanouts, FCO:
 - 1. Standard: ASME A112.36.2M for adjustable housing cleanout.
 - 2. Size: Same as connected branch.
 - 3. Coated cast iron internal gasketed ABS cleanout plug and adjustable ABS housing.
 - 4. Medium-duty scoriated secured round satin finish Nikaloy top. D. Wall

Cleanouts, WCO:

- 1. Standard: ASME A112.36.2M. Include wall access.
- 2. Size: Same as connected drainage piping.
- 3. Round stainless steel wall access cover with screw and no-hub cleanout.

2.2 FLOOR DRAINS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Josam Company.
 - 2. Smith, Jay R. Mfg. Co.
 - 3. Tyler Pipe; Wade Div.
 - 4. Zurn Plumbing Products Group. B. Floor Drains, **FD**:

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

SANITARY WASTE PIPING SPECIALTIES

1. Refer to Firestopping and Fireproofing specifications for requirements.

2.4 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. 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 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING

SPECIALTIES A. Deep-Seal Traps:

- 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
- 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch-minimum water

seal. B. Air-Gap Fittings:

- 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
- 2. Body: Bronze or cast iron.
- 3. Inlet: Opening in top of body.
- 4. Outlet: Larger than inlet.
- 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

SANITARY WASTE PIPING SPECIALTIES

C. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

2.6 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 - 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 - 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed. D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. 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 100 feet.
 - 4. Locate at base of each vertical soil and waste stack.

SANITARY WASTE PIPING SPECIALTIES

- C. For floor cleanouts for piping below floors, install cleanout with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. 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. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1 inch total depression.
 - 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.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- 3.2 CONNECTIONS

SANITARY WASTE PIPING SPECIALTIES

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to applicable Division 07 Section.
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

SANITARY WASTE PIPING SPECIALTIES

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 **PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF DOCUMENT 22 13 19

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Commercial, electric, storage, domestic water heaters.
 - 2. Thermostat-control, electric, tank-less, domestic water heaters.
 - 3. Domestic-water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. LEED Submittal:
- 1. Product Data for Prerequisite EA 2: Documentation indicating that units comply

with ASHRAE/IESNA 90.1, Section 7, "Service Water Heating." C. Shop Drawings:

- 1. Wiring Diagrams: For power, signal, and control wiring.
- D. Domestic Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Operation and maintenance data.
- H. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components Health Effects."

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Electric, Storage, Domestic Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.
 - b. Electric, Tank-less, Domestic Water Heaters: One year.
 - c. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC WATER HEATERS

- A. Commercial, Electric, Storage, Domestic Water Heaters:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on drawings or comparable product by one of the following:
 - a. A. O. Smith.

- b. Lochinvar Corporation.
- c. PVI Industries, LLC.
- d. State Industries.
- 2. Standard: UL 1453.
- 3. Storage-Tank Construction: ASME-code, steel vertical arrangement.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - 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.
- 4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valves: ASME rated and stamped for combination temperatureandpressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
- 5. Special Requirements: NSF 5 construction.
- 6. Capacity and Characteristics: As indicated on the drawings.
- 7. Temperature Setting: 140 deg F.

2.2 ELECTRIC, TANKLESS, DOMESTIC WATER HEATERS

- A. Thermostat-Control, Electric, Tank-less, Domestic Water Heaters:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on drawings or comparable product by one of the following:
 - a. Bosch Water Heating.
 - b. Chronomite Laboratories, Inc.
 - c. E-Tankless Water Heaters Corp.
 - 2. Standard: UL 499 for electric, tank-less, (domestic water heater) heating appliance.
 - 3. 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: Thermostat.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
 - 4. Support: Bracket for wall mounting.
 - 5. Capacity and Characteristics: As indicated on the drawings.

2.3 DOMESTIC WATER HEATER ACCESSORIES

- A. Domestic-Water Compression Tanks:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL Inc.
 - b. A. O. Smith.
 - c. State Industries.
 - d. Taco, Inc.

- 2. Description: Steel pressure-rated tank constructed with welded joints and factoryinstalled butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
- 3. 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.
- 4. Capacity and Characteristics: as indicated on the drawings.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 gardenhose threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE 90.2.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- F. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating. G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- H. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic water heater and water when indicated on the drawings.
- 2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic Water Heater Mounting: Install commercial, electric, domesticwater heaters on concrete base. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-Place Concrete".
 - 1. Exception: Omit concrete bases for commercial, electric, domestic water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated on the drawings.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 7. Anchor domestic-water heaters to substrate.
- B. Electric, Tank-less, Domestic Water Heater Mounting: Install electric, tank-less, domestic water heaters 18 inches on wall bracket.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
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- 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- 5. Anchor domestic-water heaters to substrate.
- C. Install electric, domestic 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.
 - 1. Install shutoff valves on domestic water supply piping to domestic water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. 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-waterheater 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.
- E. 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 electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."
- F. Install thermometers on outlet piping of electric, domestic water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- G. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- H. Fill electric, domestic water heaters with water.
- I. Charge domestic water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

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B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

END OF DOCUMENT 22 33 00

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

This Section includes the following:

- 1. Certain Definitions.
- 2. References and Standards.
- 3. Certain Submittals.
- 4. General Quality Assurance and Safety Requirements.
- 5. General Operation and Maintenance Manual Requirements.
- 6. Chicago and Evanston Campus Steam Service Information.
- 7. Special Warranties.
- 8. General Delivery, Storage and Handling Requirements.
- 9. General Coordination Requirements.
- 10. General Product and Material Requirements.
- 11. General Requirements for Grout.
- 12. General Requirements for HVAC Demolition, Equipment Installation, Concrete Bases, and Erection of Metal and Wood Supports and Anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 REFERENCES AND STANDARDS:

- A. The editions recognized by the latest edition of the following are hereby included in and made a part of Division 23:
 - 1. NFPA National Fire Protection Association
 - 2. UL Underwriters' Laboratories, Inc.
 - 3. AFI Air Filter Institute
 - 4. NEMA National Electrical Manufacturer's Association
 - 5. NEC National Electric Code
 - 6. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
 - 7. ARI American Refrigeration Institute
 - 8. AMCA Air Moving and Conditioning Association
 - 9. ASME American Society of Mechanical Engineers
 - 10. AWS American Welding Society
 - 11. ANSI American National Standards Institute
 - 12. AGA American Gas Association
 - 13. SMACNA Sheet Metal and Air Conditioning Contractors National Association
 - 14. HI Hydronics Institute
 - 15. OSHA Occupational Safety and Health Act
 - 16. MSS Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc.
 - 17. ASTM American Society for Testing and Materials

1.5 SUBMITTALS

- A. Welding certificates.
- **B.** For any equipment/components used by the contractor during construction, submit preventative maintenance records for same.
- C. Shutdown "Methods of Procedures", see 1.11-E.
- **D.** Notification to Work Forms, see 1.11-A.
- *E.* Operation and Maintenance Manuals: In PDF format.
- *F.* Northwestern University Maintenance Requirement Forms, see Division 01.
- **G.** As specified elsewhere in this Section.
- 1.6 QUALITY ASSURANCE, COORDINATION, AND SAFETY
 - A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
 - B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

- 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
- 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements. D. Meet all in-force University, OSHA, state, and local safety requirements.

- E. To meet the University goals of safety, reliability, serviceability, and efficient operation, all contractors shall use the burn permit procedure Burn permits are issued b the Facilities Management Operations Engineering Department. The respective trades that are performing any hot work must pick up a Burn Permit prior to commencing any work. Prior to the Burn Permit being picked up, the respective contractor will provide and indicate on the Burn Permit the Northwestern University work order. All procedures indicated on the Burn Permit are to be followed.
- F. All work to meet in-force local plumbing code. In the case of discrepancies between the project contract documents and the in-force local code, the most stringent shall govern. G. Comply with most current edition of Northwestern University Design Standards.
- H. All materials and installations shall meet applicable FM Global requirements.
- I. Complete Project Closeout list, Pre-Occupancy checklist, and Project Turnover checklist prior to project turnover to Owner.

1.7 GENERAL OPERATION AND MAINTENANCE MANUAL REQUIREMENTS

- A. Two weeks prior to shipment, the contractor shall submit three (3) bound copies (One copy for archive, two for shop use. One to the actual shop location and one left on site.) of operating and maintenance data on all equipment furnished (separated by individual unit) to include, but not limited to, the following: Shop Drawings; Model, system/tag and serial numbers of all equipment; Performance data/curves; Fan curves for fans with variable frequency drives shall show fan performance at various percentages of frequency/speed from 100% to 0% in 10% increments; Manufacturer's written instructions for the operation and maintenance of the component equipment; Lubrication schedule indicating all equipment to be lubricated, recommended lubrication interval, and type and quality of lubricant to be used; recommended spare parts. And, submitter must obtain signed proof in writing that the University received this information.
- B. All of the above listed documents shall be provided in electronic format to each division in addition to the Northwestern University archives.
- C. Two of the bound copies are to be distributed to the Evanston Engineer's Department. One copy is to be located in the associated mechanical room and another to the shop. The associated

manuals will be stored on a project supplied book shelf. Prints are to be installed on a vertical wall mounted print storage rack.

- 1. Two copies Single line, full size, piping and ventilation prints laminated and stored on the respective print storage device. One copy is for the building and the other is for the shop files.
- 2. Two copies of the piping print showing floor and branch isolation valves indicated by the respective tag number.
- 3. Two copies of the ventilation print showing all smoke and fire dampers.
- E. Provide verification with Northwestern University Engineering Department to make sure there is record of them receiving Operation and Maintenance Manual.

1.8 SPECIAL WARRANTIES

- A. Five years for new equipment and work, see Division 01.
- B. Extended warranties for equipment/work utilized by contractor during construction, see Division 01.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Piping, duct, equipment, and associated accessories kept on-site should be stored off the ground on skids, ends should be capped or sealed, and these items should be covered with plastic to prevent fouling or contact with excessive moisture. Piping, duct, and equipment should be cleaned of debris inside and out before installation and should be kept clean and protected throughout construction.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- 1.10 COORDINATION, INCLUDING WITH THE UNIVERSITY, FOR SHUTDOWNS
 - A. All contractors are to fill out and submit University Notification of Work Forms, and coordinate with the respective University Project Manager.
 - B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC 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. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

E. All shutdowns are to be requested with the respective University Project Manager. All shutdowns must have a shutdown request filled out for the applicable trade and submitted to the respective trades's shop calendar 48 hours in advance, they shall include Methods of Procedure. Emergency situations will be addresses and a case by case basis.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT AND MATERIALS:
 - A. All equipment and materials shall be furnished in strict accordance with the equipment named and according to Specification requirements. Each bid shall be based upon one of the materials or manufacturers specified.
 - B. Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.
 - C. Where multiple manufacturers are named the drawings and specifications are based on the requirements and layouts for the equipment of the first named manufacturer. Any change required by the use of other named manufacturers such as revisions to foundations, bases, piping, controls, wiring, openings, and appurtenances shall be made by the Contractor at no additional cost to the Owner. Changes must be submitted to the University for approval.

2.2 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Refer to Division 01 Section covering cutting and patching" and Division 02 Section covering demolition for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

- 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
- 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
- 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- 8. All piping and ductwork that is not to be reused shall be removed back to the nearest main and capped/plugged with similar material.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 GENERAL REQUIREMENTS

- A. All work shall be installed in a neat, workmanlike, and professional manner.
- B. All materials and equipment provided under this contract shall be new (except where otherwise noted) and shall be listed, labeled or certified by Underwriters Laboratories, Inc., or other acceptable entity.
- C. All materials, products, and equipment being installed which fall into a category covered by the [®]
 <u>ENERGY STAR</u> program must be labeled as such.
- D. All equipment of the same type shall be by the same manufacturer.
- E. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the diffuser"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.
- F. During construction the contractor shall at all times maintain HVAC utilities of the building without interruption. Should it be necessary to interrupt any HVAC service or utility, the contractor shall secure permission in writing from the University for such interruption at least seven days in advance. Any interruption shall be made with minimum amount of inconvenience

to the University and any shut-down time shall have to be on a premium time basis and such time to be included in the contractor's bid. Arrange to provide and pay for temporary HVAC if required by project conditions.

G. Measure indicated mounting heights to bottom of units/work for suspended items and to center of items of work for wall-mounted items.

- H. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- I. Working clearance around equipment shall not be less than that specified by the in-force codes, standards, and the equipment manufacturer's instructions.
- J. The locations of sensors, grilles, registers, diffusers, equipment, piping, ductwork, etc. shown are approximate. The contractor shall use good judgment in placing the preceding items to eliminate all interference with lights, cabinetry, sprinklers, etc. The contractor shall check all furniture plans so that wall mounted sensors, panels, etc., are not located behind same. Relocate same as required, with approval from the Architect and Engineer. The University may direct relocation of sensors before installation, up to five (5) feet from the position indicated on the Drawings, without additional cost.
- K. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both HVAC equipment and other nearby work/installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity. Normal maintenance shall not require the removal of protective guards from adjacent equipment. Install equipment as close as practical to the locations shown on the Drawings.
 - 1. Where the University determines that the Contractor has installed equipment not conveniently accessible for operations and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the University.
 - 2. "Conveniently Accessible" is defined as being capable of being reached/serviced/maintained without climbing or crawling over or under obstacles such as ductwork, large conduits or banks of conduits, large piping or banks of piping, or similar.
- L. Coordinate work with all other trades. This is to include coordinating to eliminate interference to allow proper access to equipment doors, access to valves, and to not interrupt equipment or devices proper operation.
- M. Firestopping shall be applied to HVAC penetrations of fire-rated floor and wall assemblies to restore/create the required fire-resistance rating of the assembly according to appropriate Division 07 and 09 Sections and the University Fire Protection Group. All floor or wall penetrations will be sleeved with the same or compatible material and appropriately firestopped.
- N. Owner Furnished Equipment: Equipment furnished by the University shall be received, stored, protected, uncrated, moved into position, and installed by the Contractor with all appurtenances required to place the equipment in operation, ready for use. The Contractor shall be responsible for the equipment as if he had purchased the equipment himself/herself.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Provide access to mechanical equipment, components, and work per manufacturer's recommendations.
- E. Minimum service access size for HVAC equipment/components above ceilings shall be 24" cubed.
- F. Install equipment to allow right of way for piping installed at required slope.
- G. Install equipment to allow for proper access to all ancillary devices that are part of the equipment. This includes valves, circuit setters, building automation system controllers.
 - 1. If valves are not readily accessible for proper isolation, adequate pipe spacing needs to be allowed with consideration given to insulation that will be installed.
 - 2. Valves that are located in areas where access is difficult will be installed at the three or nine o'clock position to allow for service. If this any question about the serviceability, the owner's appropriate representative will be consulted for review.

3.4 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Install dowel rods to connect concrete base to concrete floor.
 - 2. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete" unless otherwise noted on the drawings.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment. C. Field Welding: Comply with AWS D1.1.

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.
- D. All wood used to be fire retardant/treated wood, to be approved by the Architect, and is to be used minimally.
- 3.7 GROUTING
 - A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
 - B. Clean surfaces that will come into contact with grout.
 - C. Provide forms as required for placement of grout.
 - D. Avoid air entrapment during placement of grout. E. Place grout, completely filling equipment bases.
 - F. Place grout on concrete bases and provide smooth bearing surface for equipment.
 - G. Place grout around anchors.
 - H. Cure placed grout.

END OF DOCUMENT 23 00 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Advance Products & Systems, Inc.
- 2. CALPICO, Inc.
- 3. Metraflex Company (The).
- 4. Pipeline Seal and Insulator, Inc.
- 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel or Stainless steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 - 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 - 3. Using sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls.
 Position waterstop flange to be centered in concrete slab or wall. C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves, Galvanized-steelpipe sleeves, or Sleeve-seal fittings.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves or Galvanized-steelpipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system, galvanized-steel-pipe sleeves with sleeve-seal system, or sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel-pipe sleeves with sleeve-seal system, or Sleeve-seal fittings.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system, Galvanized-steel-pipe sleeves with sleeve-seal system, or Galvanizedsteel-pipe sleeves.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves orSleeveseal fittings.

- b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.
- 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF DOCUMENT 23 05 17

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. Vibration Isolation Mounts and Hangers
 - a. Isolation pads.
 - b. Isolation mounts.
 - c. Restrained elastomeric isolation mounts.
 - d. Restrained spring isolators.
 - e. Elastomeric hangers.
 - f. Spring hangers.
 - g. Spring hangers with vertical-limit stops.
 - 2. Vibration Isolation Equipment Bases
 - a. Structural Steel Frame Inertia Bases
 - b. Concrete Inertia Bases
 - 3. Rooftop Equipment Vibration Isolation
 - a. Curb-Mounted Fiberglass Strips
 - b. Curb-Mounted Spring Rail
 - c. Sheet Metal Restraint / Spring Isolation Curbs.
 - 4. Acoustical Pipe Seals
 - 5. All-Directional Acoustical Pipe Anchors.
 - 6. Telescoping Type Vertical Sliding Guides.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. ASCE-7, Minimum Design Loads for Buildings and Other Structures
- D. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

- E. American Society for Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)
- F. The Vibration Isolation and Seismic Control Manufacturers Association (VISCMA)

1.4 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. For Basic Wind Speed and Building Classification Category, please refer to the project Structural Drawings.
 - 2. Project design value in lb/sq. ft. (kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.5 ACTION SUBMITTALS

- A. All vibration isolation products and wind restraints must be by a single manufacturer.
- B. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 - 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.
- C. Delegated-Design Submittal: For vibration isolation and restraint details 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. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, and wind forces required to select vibration isolators, and wind restraints, and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

- 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
- 3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
- 4. Wind Restraint Details:
 - a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during wind events. Indicate association with vibration isolation devices.
 - c. Coordinate restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - d. Pre-approval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of required clearances and bracing for HVAC duct and equipment with other systems and equipment in the vicinity, including other supports, wind restraints, housekeeping pads, and roof curbs.
- B. Qualification Data: For professional engineer, manufacturer, installer, and testing agency.
- C. Welding certificates.
- D. Field quality-control test reports.
- 1.7 FIELD MEASURE
 - A. Verify field measurements prior to fabrication.
- 1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with wind design/restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."

PART 2 - PRODUCTS

2.1 General

- A. Metal parts of vibration isolation units installed out-of-doors shall be hot-dipped galvanized, cadmium-plated, or Neoprene-coated after fabrication. Galvanizing shall meet ASTM 44 "Salt Spray Test Standards and Federal Test Standard."
- B. Spring elements shall be powder coated and tested in salt spray fog test per ASTM B117 standards
- C. Spring elements shall have a lateral stiffness greater than 0.8 times the rated vertical stiffness and shall be designed to provide up to 50% overload capacity before solid state is reached. Spring shall be safe at solid state.
- D. Spring elements shall be color coded or otherwise identified to indicate load capacity.
- E. Isolator types are scheduled to establish minimum standards. Optionally, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation, and initial system filling operations, and similar installation advantages. Accessories shall not degrade vibration isolation systems.
- F. Vibration Isolators shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the vibration isolation schedule listed in this specification.
- G. Refer to schedules on drawings covering devices specified herein.

2.2 VIBRATION ISOLATION MOUNTS AND HANGERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber Booth Company.
 - 2. Kinetics Noise Control.

- 3. Mason Industries.
- 4. Vibration Mountings and Controls, Inc.
- 5. Vibro-Acoustics.
- B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment. Minimum static deflection .25"
 - 1. Resilient Material: Oil- and water-resistant neoprene, rubber, or hermetically sealed compressed fiberglass.
- C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range. Minimum static deflection .25"
 - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridgebearing neoprene as defined by AASHTO.
- D. Restrained Spring Isolators: Freestanding, steel, housed (Type C mounting), isolators with limitstop restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation. A minimum clearance of ½" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Housing shall be designed to resist all wind forces as applicable per building codes.
 - 2. Restraint: Limit stop as required for equipment and authorities having jurisdiction. Restraining bolts shall have a neoprene busing between the bolt and the housing. Limit stops shall be out of contact during normal operation.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- E. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oilresistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

- F. Spring Hangers: Combination coil-spring and fiberglass-insert hanger with spring and insert in compression.
 - 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Fiberglass Element: Molded, oil-resistant fiberglass. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - 7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- G. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and fiberglassinsert hanger with spring and insert in compression and with a vertical-limit stop.
 - 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Fiberglass Element: Molded, oil-resistant fiberglass.
 - 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber Booth Company.
 - 2. Kinetics Noise Control.
 - 3. Mason Industries.
 - 4. Vibration Mountings & Controls, Inc.
 - 5. Vibro-Acoustics.

- B. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than a 2-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 2. Include supports for suction and discharge elbows for pumps.
 - 3. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 4. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - 5. All vibration isolated structural frame base equipment shall have flexible connectors on all attached piping, duct, conduit, etc. as to fully isolate the unit.
- C. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails including placement of castin-place concrete.
 - 1. Design Requirements: Lowest possible mounting height with not less than a 2-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - 2. Include supports for suction and discharge elbows for pumps.
 - 3. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 4. Support Brackets: Factory-welded steel brackets on frame for isolation mountings and to provide for anchor bolts and equipment support.
 - 5. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.
 - 6. All vibration isolated concrete inertia base equipment shall have flexible connectors on all attached piping, duct, conduit, etc as to fully isolate the unit.
 - 7. Cast-In-Place Concrete: Fill base with concrete per bas manufacturer's instructions, using concrete meeting concrete specs.

2.4 ROOFTOP EQUIPMENT VIBRATION ISOLATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kinetics Noise Control.
 - 2. Mason Industries.
 - 3. Thybar Corporation.
 - 4. Vibration Eliminator Co., Inc.
 - 5. 5. Vibration Mountings & Controls, Inc.
- B. General Requirements
 - 1. Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand project wind forces.

- 2. All components within the final product and including the final product are to be manufactured within the United States of America.
- 3. Complete curb and isolation assembly shall be stamped by a Professional Engineer licensed in the jurisdiction of the project.
- 4. Provide sloped and/or extended height curb assemblies as necessary to coordinate with roof slope and buildup.
- 5. All vibration isolated structural frame base equipment shall have flexible connectors on all attached piping, duct, conduit, etc. as to fully isolate the unit.
- C. Curb-Mounted Fiberglass Strips
 - 1. Fiberglass continuous support material shall be high-density matrix of compressed molded fiberglass; individually coated with a flexible moisture-impervious elastomeric membrane.
 - 2. Material is to be non-corrosive, non-combustible, non-absorbent, and resists rust, ozone, mildew, and fungus.
 - 3. Material will not shrink, swell, or decompose.
 - 4. Isolation characteristics of the media are to remain constant over a temperature range of 40F to 250F.
- D. Curb Mounted Spring Rail
 - 1. Full-perimeter rail type isolator, spring components shall be 1" or 2" deflection, freestanding, un-housed, laterally stable steel spring. Springs have a lateral stiffness greater than 1.0 times the rated vertical stiffness and shall be designed for 50% overload to solid.
 - 2. Rails shall provide continuous support for the rooftop equipment and shall consist of extruded aluminum top and bottom members connected by spring isolators and a continuous air and water-tight seal.
 - 3. Curb Mounted Spring Rail is mounted on existing roof curb or curbs provided by others.
- E. Sheet Metal Restraint / Spring Isolation Curbs
 - 1. Lower Support Assembly: Formed sheet-metal section containing steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.
 - 2. Spring Isolators: restrained spring isolators shall be mounted on 1/4-inch- (6-mm-) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
 - a. Restrained Spring Isolators: Steel, open-spring isolators with wind restraint.

- 1) Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
- 2) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 3) Minimum Additional Travel: 50 percent of the required deflection at rated load.
- 4) Lateral Stiffness: More than 80 percent of rated vertical stiffness.
- 5) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- b. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1) Resilient Material: Oil- and water-resistant standard neoprene, natural rubber, or hermetically sealed compressed fiberglass.
- 3. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.
- 4. Water Seal: EPDM or Galvanized sheet metal weather seal attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.5 ACOUSTICAL PIPE SEALS

- A. Split seals shall consist of pipe halves with minimum 3/4" thick neoprene sponge cemented to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed in around the seal to make it integral with the floor, wall, or ceiling if the seal is not in place prior to the construction of the building surface or member.
- B. Seals shall project a minimum of 1" past either face of walls. Where temperatures exceed 240°F,
 10 pound density fiberglass may be used in lieu of the sponge. C. Seals shall be Type SWS by
 Mason Industries or approved equal.

2.6 TELESCOPING TYPE VERTICAL SLIDING GUIDES

A. Guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum of 1/2" thickness of 60 durometer or softer neoprene. The height of the guides shall be preset with a set screw/bolt to allow vertical motion due to pipe expansion or contraction. Guides shall be capable of +/- 1.625" motion, or to meet location requirements. B. Guides shall be Type VSG by Mason Industries or approved equal.

2.7 ALL DIRECTIONAL ACOUSTICAL PIPE ANCHORS

A. Guides shall consist of f two sizes of steel tubing separated by a minimum of 1/2" thickness of 60 durometer or softer neoprene. Vertical restraint shall be provided by similar material arranged to prevent up or down vertical travel. Allowable loads on the isolation material shall not exceed 500 psi and the design shall be balanced for equal resistance in any direction. B. Guides shall be Type ADA by Mason Industries or approved equal.

2.8 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces. C. All rotating equipment shall have vibration isolation from building structure.

- D. Ducts within 50' of fan discharges shall be isolated by spring hangers with neoprene cups.
- E. The first three hangers and floor supports from equipment (i.e. pumps, etc.) shall be isolated by spring hangers with neoprene cup for pipe and spring isolated concrete inertia base mounts respectively.
- F. Pipes passing through equipment room walls, floors, or ceilings shall have all directional acoustical pipe seals.
- G. Pipe risers shall bne suspended from or supported by all directional acoustical pipe anchors and telescoping type guides.
- H. All supply fans and pumps are to have at least four isolation springs located at the corners of the equipment.

3.3 VIBRATION-CONTROL AND RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations. B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance

between anchor and adjacent surface exceeds 0.125 inch (3.2 mm). C. Piping Restraints:

- 1. Comply with requirements in MSS SP-127.
- 2. Space lateral supports and brace change of direction following SMACNA and VISCMA recommendations per a professional engineer.
- D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- E. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members. G. Drilled-in Anchors:
 - Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

- 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole

and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

- 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
- 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner shall engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. Verify snubber minimum clearances.
 - 9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.
- 3.6 DEMONSTRATION
 - A. Refer to Division 01 Section covering demonstration and training.
- 3.7 HVAC VIBRATION-CONTROL AND RESTRAINT DEVICE SCHEDULE AND SUPPLY FAN AND HVAC PUMP APPLICATION
 - A. See drawing schedules but, the minimum mounting deflection for spring isolators shall be as follows: 300 rpm, 3.5"; 500 rpm, 1.65"; 800 rpm, 1.00"; 1200 rpm and higher, 0.80".
 - B. All supply fans and HVAC pumps are to have at least (4) spring isolators located at the corners of the fans/pumps.

END OF DOCUMENT 23 05 50

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes testing, adjusting and balancing HVAC systems to provide design conditions as indicated by the associated drawings. This Section includes, but is not limited to the following:
 - 1. Balancing Air Systems Constant air volume and variable-air-volume systems.
 - 2. Balancing Hydronic Piping Systems Constant and variable-flow hydronic systems, and primary-secondary systems.
 - 3. Measuring the electrical performance of HVAC equipment.
 - 4. Verification that automatic control devices are functioning properly.
 - 5. Measurement of sound levels as related to rotating mechanical equipment.
 - 6. Vibration testing and analysis of all rotating equipment greater than or equal to 10 hp.
 - 7. Measurement of duct leakage.
 - 8. Reporting results of the activities and procedures specified in this Section.
- B. The testing, adjusting and balancing of the air and hydronic systems shall be performed by an independent TAB contractor contracted directly by the University, and approved companies are Arrow Testing and Balancing, CEPro, Hill Mechanical, and ITB (Independent Test and Balance).

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. Adjust: To regulate fluid flow rates and air patterns at the system or terminal level. At the system level an example would be reducing fan speed; at the terminal level an example would be changing a damper position.
- C. Balance: To proportion air or water flows within the distribution system, including submains, branches and terminals with respect to design quantities.
- 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. Independent: Not affiliated with or in employment of any Contractor.
- F. NEBB: National Environmental Balancing Bureau.
- G. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- H. Report Forms: Test data sheets for recording test data in logical order.
- I. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

- J. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- K. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- L. 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.
- M. TAB: Testing, adjusting, and balancing.
- N. TAB Specialist: An entity engaged to perform TAB Work.
- O. Testing, Adjusting and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.
- P. Terminal: A point where the controlled medium (fluid or energy) enters or leaves the distribution system.
- 1.3 PREINSTALLATION MEETINGS
 - A. TAB Conference: If requested by the Owner, conduct a TAB conference at project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.
- 1.4 ACTION SUBMITTALS

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 90 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 90 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

- D. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC or NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation" but in all cases, all instrumentation used for testing shall be calibrated within 6 months of use, an accuracy of the instrumentation shall not be less than what is specified by the instrument manufacturer.
- C. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 "Air Balancing."
- E. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 "System Balancing."
- 1.7 FIELD 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.

- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- 1.8 WARRANTY
 - A. Provide one of the following performance guarantees:
 - 1. AABC National Project Performance Guarantee
 - 2. NEBB Certificate of Conformance Certification
 - 3. TABB Quality Assurance Program Guarantee
 - B. Guarantee shall include provisions that the certified TAB firm has tested and balanced systems according to the Contract Document and that the systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS

- 2.1 INSTRUMENT TEST HOLES
 - A. To be Ventlock #699,

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Ductwork" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed. H. Examine test reports specified in individual system and equipment Sections.

- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.

TESTING, ADJUSTING, AND BALANCING
- 5. Balance, smoke, and fire dampers are open.
- 6. Isolating and balancing valves are open and control valves are operational.
- 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
- 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2007, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test holes and probes to the extent necessary for TAB procedures, and duct test hole fittings shall be provided where shown on the drawings or specified in the Data sheets. T&B instrument test holes to be Ventlock #699.
 - After testing and balancing, install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "Mechanical System Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaustair dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23 Section "Ductwork."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heatrecovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

- 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fanmotor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 - 3. Remeasure each submain and branch duct after all have been adjusted. Continue

to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

- 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - 1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

- 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
- 3. Measure total system airflow. Adjust to within indicated airflow.
- 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
- 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
- 6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
- 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
- 8. Record final fan-performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - 1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
 - 2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 - 3. Set terminal units at full-airflow condition.
 - 4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 - 5. Adjust terminal units for minimum airflow.
 - 6. Measure static pressure at the sensor.
 - 7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check charging/liquid levels in expansion tanks.
 - 3. Check makeup water-station pressure gage for adequate pressure for highest vent.
 - 4. Check flow-control valves for specified sequence of operation, and [set at indicated flow] [verify flow matches gpm on flow control valve].
 - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
 - 6. Set system controls so automatic valves are wide open to heat exchangers.
 - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded, or inform Engineer if pump does not have a flow control device at the discharge of the pump.
 - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Adjust pumps to deliver total design gpm.
 - 1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - 2. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
 - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

- 3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- B. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - 1. Measure flow in main and branch pipes.
 - 2. Adjust main and branch balance valves for design flow.
 - 3. Re-measure each main and branch after all have been adjusted.
- C. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - 1. Measure flow at terminals.
 - 2. Adjust each terminal to design flow.
 - 3. Re-measure each terminal after it is adjusted.
 - 4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - 5. Perform temperature tests after flows have been balanced.
- D. For systems with pressure-independent valves at terminals:
 - 1. Measure differential pressure and verify that it is within manufacturer's specified range.
 - 2. Perform temperature tests after flows have been verified.
- E. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - 1. Measure and balance coils by either coil pressure drop or temperature method.
 - 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- F. Verify final system conditions as follows:
 - 1. Re-measure and confirm that total water flow is within design.
 - 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - 3. Mark final settings.
 - 4. Verify that memory stops have been set.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above in section 3.7 for hydronic systems.
- 3.10 Systems installed with pressure independent control valves shall not require full hydronic system balancing. Flow shall be verified for the pressure independent valve assembly (valve and actuator combination) for field conditions using the pressure independent control valve manufacturer's documented procedure for 20% of the total installed product. Exact locations of tested product to be coordinated with the drawings.

3.11 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first.
- B. Balance the secondary circuits after the primary circuits are complete.
- C. Adjust pumps to deliver total design gpm.
 - 1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - 2. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved. . Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- D. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - 1. Measure flow in main and branch pipes.
 - 2. Adjust main and branch balance valves for design flow.
 - 3. Re-measure each main and branch after all have been adjusted.
- E. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - 1. Measure flow at terminals.
 - 2. Adjust each terminal to design flow.
 - 3. Re-measure each terminal after it is adjusted.
 - 4. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - 5. Perform temperature tests after flows have been balanced. F. For systems with

pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.

- 2. Perform temperature tests after flows have been verified.
- G. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - 1. Measure and balance coils by either coil pressure drop or temperature method.
 - 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- D. Verify final system conditions as follows:
 - 1. Re-measure and confirm that total water flow is within design.
 - 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - 3. Mark final settings.
- E. Verify that memory stops have been set.
- 3.12 PROCEDURES FOR STEAM SYSTEMS
 - A. Measure and record upstream and downstream pressure of each piece of equipment.
 - B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.
 - C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
 - D. Check settings and operation of each safety valve. Record settings.
 - E. Verify the operation of each steam trap.

3.13 PROCEDURES FOR HEAT EXCHANGERS

- A. Adjust water flow to within specified tolerances.
- B. Measure inlet and outlet water temperatures.
- C. Measure inlet steam pressure.
- D. Check settings and operation of safety and relief valves. Record settings.
- 3.14 PROCEDURES FOR MOTORS
 - A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Phase and hertz.
 - 5. Nameplate and measured voltage, each phase.

TESTING, ADJUSTING, AND BALANCING

- 6. Nameplate and measured amperage, each phase.
- 7. Starter size and thermal-protection-element rating.
- 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.
- 3.15 PROCEDURES FOR COOLING TOWERS
 - A. Balance total condenser-water flows to towers. Measure and record the following data:
 - 1. Condenser-water flow to each cell of the cooling tower.
 - 2. Entering- and leaving-water temperatures.
 - 3. Wet- and dry-bulb temperatures of entering air.
 - 4. Wet- and dry-bulb temperatures of leaving air.
 - 5. Condenser-water flow rate recirculating through the cooling tower.
 - 6. Cooling-tower spray pump discharge pressure.
 - 7. Condenser-water flow through bypass.
 - 8. Fan and motor operating data.

3.16 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.

3.17 PROCEDURES FOR BOILERS

- A. Hydronic Boilers:
 - 1. Measure and record entering- and leaving-water temperatures.
 - 2. Measure and record water flow.
 - 3. Record relief valve pressure setting. B. Steam Boilers:
 - 1. Measure and record entering-water temperature.
 - 2. Measure and record feed water flow.
 - 3. Measure and record leaving-steam pressure and temperature.
 - 4. Record relief valve pressure setting.

3.18 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do

not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

- 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
- 2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
- 3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
- 4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
- 5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
- 6. Capacity: Calculate in tons of cooling.
- 7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.19 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
 - 7. Air pressure drop.
- B. Measure, adjust, and record the following data for each electric heating coil:
 - 1. Nameplate data.
 - 2. Airflow.
 - 3. Entering- and leaving-air temperature at full load.
 - 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 - 5. Calculated kilowatt at full load.
 - 6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Airflow.
 - 3. Air pressure drop.
 - 4. Inlet steam pressure.
- D. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.

- 4. Air pressure drop.
- 5. Refrigerant suction pressure and temperature.

3.20 TOLERANCES/ACCEPTED CRITERIA

- 1. For most spaces, the total supply air quantity to each space of a system shall be within 5% to +10% of design. Review project specific requirements with NU Project Manager.
- 2. The percent tolerance of each outlet within a space shall be per Table 23 0594-1.

Table 23 0594-1						
System	Number of Outlets in Space					
	1	2	3 or More			
Single Zone,	-5%	±10%	± 15%			
Multizone, VAV	+10%					
Heating and	-5%	±15%	±15%			
Ventilating	+10%					

- 3. Air quantity of each return air grille and diffuser shall be within ±10% of design. The design room pressurization must be maintained regardless of the tolerance at each individual diffuser.
- 4. Vivariums: In general, these laboratories shall be under negative pressure. The design should meet the current NIH Design Requirements Manual for Biomedical Laboratories and Animal Research Facilities. Any reduction in airflow shall be presented by the project Engineer of Record and reviewed by the NU Project Manager and Project Engineer.
- 5. Culture Rooms: These rooms shall be under positive pressure.
- 6. Hydronic Systems: Heating and cooling hydronic systems shall be balanced so that the flow is from 0 to +5% of design at each coil.
- 7. Combination fire/smoke dampers in dynamic smoke control systems shall be tested for closure under airflow conditions (International Mechanical Code 2009, Section 607), and to assure positive pressure of certain zones, and negative pressure for other zones. Smoke dampers in dynamic smoke control systems must close under airflow conditions.

3.21 REPORTING

- A. All test reports are to have an Executive Summary which shall state extent of system compliance, system deficiencies, and recommended changes.
- B. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- C. Status Reports: Prepare bi-weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems

found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.22 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration. B. Final

Report Contents: In addition to certified field-report data, include the following:

- 1. Pump curves.
- 2. Fan curves.
- 3. Manufacturers' test data.
- 4. Field test reports prepared by system and equipment installers.
- 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB contractor.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.

- c. Cooling coil, wet- and dry-bulb conditions.
- d. Face and bypass damper settings at coils.
- e. Fan drive settings including settings and percentage of maximum pitch diameter.
- f. Inlet vane settings for variable-air-volume systems.
- g. Settings for supply-air, static-pressure controller.
- h. Settings for differential pressure, hydronic differential control
- i. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - 1. Quantities of outdoor, supply, return, and exhaust airflows.
 - 2. Water and steam flow rates.
 - 3. Duct, outlet, and inlet sizes.
 - 4. Pipe and valve sizes and locations.
 - 5. Terminal units.
 - 6. Balancing stations.
 - 7. Position of balancing devices.

3.23 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF DOCUMENT 23 05 94

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: 1. Insulation

Materials:

- a. Flexible elastomeric.
- b. Mineral fiber.
- 2. Duct Fire Wrap 3.
 - Insulating cements.
 - 4. Adhesives.
 - 5. Mastics.
 - 6. Sealants.
 - 7. Field-applied jackets.
 - 8. Removable insulation covers.
 - 9. Tapes.
 - 10. Securements.
 - 11. Corner angles. B. Related Sections:
- 1. Section 23 2113 "Hydronic Piping."
- 2. Section 23 2116 "Hydronic Piping Specialties."
- 3. Section 23 2123 "Pumps."
- 4. Section 23 2213 "Steam Piping."
- 5. Section 23 2216 "Steam Piping Specialties."
- 6. Section 23 3114 "Ductwork."
- 7. Section 23 5214 "Primary Heating Equipment."
- 8. Section 23 8216 "Coils."
- 9. Section 23 8413 "Humidification Equipment."

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, linkages of control devices, and specialties for each type of insulation.

- 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
- 6. Detail application of field-applied jackets.
- 7. Detail field application for each equipment type.
- D. Field quality-control reports.
- 1.3 QUALITY ASSURANCE
 - A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-testresponse characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
 - B. Materials and installation in accordance with NFPA 255, UL 723, and MICA (Midwest Insulation Contractors Association).
 - C. Insulation thickness shall meet the requirements of ASHRAE Standard 90.1 and Northwestern University Standards and shall be selected to eliminate avoid condensation.

1.4 SPECIAL WARRANTIES

A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex (Preferred).
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Atmosphere Duct Wrap.
 - d. Owens Corning; All-Service SOFTR Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainT-eed Corp.; CertaPro Commercial Board.
 - b. Johns Manville; 800 Series Spin-Glas.
 - c. Knauf Insulation; Insulation Board.
 - d. Owens Corning; Fiberglas 700 Series. I. Mineral-Fiber,

Preformed Pipe Insulation:

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; Redi-Klad 1000 Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
- 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied

jacket requirements are specified in "Factory-Applied Jackets" Article. Densities per PART 3 schedules.

- J. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semi-rigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Fabrication Board.
 - b. Knauf Insulation; Pipe and Tank.
 - c. Owens Corning; Pipe and Tank.
- 2.2 Grease Duct Insulation
 - A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. 3M Fire Barrier Duct Wrap Type 15A
 - 2. UNIFRAX Fyrewrap
 - 3. Thermal Ceramics Firemaster
 - B. Joint free, lightweight, non-asbestos, high temperature, inorganic foil encapsulated ceramic fiber blanket duct wrap for use on commercial grease hood duct systems in accordance with ASTM E2336.
 - C. A zero inch clearance to combustible construction and two (2) hour fire resistive rated enclosure system shall be assured.
 - D. Adhesives: High performance filament tape, one inch wide, and aluminum foil tape to seal cut edges of blankets.
 - E. Banding Material: Two (2) hour requirement, ³/₄" wide, no less than 0.015 inches thick, Type 304 stainless steel, (stainless steel hose clamps, ¹/₂ inch may be substituted for hanger insulations only).
 - F. Insulation Pins: 10 gage, 4 inches to 5 inches long, copper coated steel no less than 1-1/2 inch by 1-1/2 inch or 1-1/2 inch diameter galvanized steel speed clip.
 - G. Fire Stopping Materials: UL No R9464 classified noncombustible fiber with a flame spread of 0, smoke development of 0 and fuel contribution of 0. Water based, mild chemical resistant putty complying with ASTM E136-82 may be used.
- 2.3 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Rock Wool Manufacturing Company; Delta One Shot.

2.4 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated. B. Adhesives to be waterproof fire-retardant type.

2.5 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

2.6 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. For indoor applications, use sealants that have a VOC content of 420 g/L or less

when calculated according to 40 CFR 59, Subpart D (EPA Method 24). B. FSK and Metal Jacket Flashing Sealants:

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Vimasco Corporation; 750.
- 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 3. Fire- and water-resistant, flexible, elastomeric sealant.
- 4. Service Temperature Range: Minus 40 to plus 250 deg F.
- 5. Color: Aluminum.
- 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: White.
 - 5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factoryapplied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacketing and Pre-Formed Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; roll stock ready jacketing for shop or field cutting and forming, and pre-formed fitting covers. Thicknesses as indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston (Preferred), 300 Series if outdoors, 2000 series if indoors.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: White.
 - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

- 5. Factory-fabricated tank heads and tank side panels.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Finish and thickness are indicated in field-applied jacket schedules.
 - 3. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 REMOVABLE INSULATION COVERS

- A. Acceptable Manufacturers:
 - 1. Advance Thermal Corp.
 - 2. Thermal Energy Products, Inc.
 - 3. Temptec.
 - 4. Remco Technology, Inc.
- B. Removable ceramic blanket type with Velcro tabs and box-stitched, 1.5" wide, D-ring straps, gussets, hot face inner jacketing, type 304 stainless steel tag with laser engraved data riveted to body, outer jacketing, type 304 stainless steel quilting pins, specifically shaped and constructed for insulated item.

2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.

- d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
- 2. Width: 3 inches.
- 3. Thickness: 11.5 mils.
- 4. Adhesion: 90 ounces force/inch in width.
- 5. Elongation: 2 percent.
- 6. Tensile Strength: 40 lbf/inch in width.
- 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

Products: Subject to compliance with requirements, provide one of the following:

- a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
- b. Compac Corp.; 130.
- c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
- d. Venture Tape; 1506 CW NS.
- 2. Width: 2 inches.
- 3. Thickness: 6 mils.
- 4. Adhesion: 64 ounces force/inch in width.
- 5. Elongation: 500 percent.
- 6. Tensile Strength: 18 lbf/inch in width.

2.11 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal. B. Insulation Pins and Hangers:

- 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inchdiameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 2. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inchdiameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
- 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanizedsteel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert

to ensure permanent retention of cap in exposed locations. C. Wire: 0.062-inch softannealed, stainless steel.

2.12 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer. I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated (all cold work at a minimum, and it shall be continuous), seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

Install insulation continuously through hangers and around anchor attachments.

- 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
- 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

- 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,

install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

- 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
- 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping."
- F. Insulation Installation at Floor Penetrations:
 - 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Pipe: Install insulation continuously through floor penetrations.
 - Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping." G. Insulation Installation on Pumps:
 - 1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 - 2. Fabricate boxes from aluminum, at least 0.050 inch thick.

3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles. B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

- 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
- 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
- 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
- 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
- 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
- 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- 9. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainlesssteel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. B. Insulation Installation on Pipe Flanges:

- 1. Install pipe insulation to outer diameter of pipe flange.
- 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
- 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
- Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. D. Insulation Installation on Valves and Pipe Specialties:

- 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
- 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- 3. Install insulation to flanges as specified for flange insulation application.
- Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant. C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:

- 1. Install preformed sections of same material as straight segments of pipe insulation when available.
- 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
- 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- 4. Install insulation to flanges as specified for flange insulation application.
- E. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitordischarge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over-compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section. Install vapor barrier consisting of factory- or fieldapplied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vaporbarrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

- 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
- 6. For Blanket Insulation Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 7. For Board Insulation, install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 8. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 Painting Sections.
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.

- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.
- 3.9 FIELD QUALITY CONTROL
 - A. Perform tests and inspections.
 - B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
 - 2. Inspect field-insulated equipment, randomly selected by Architect, by removing fieldapplied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - 3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three Insert number locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
 - C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

A.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

Indoor, concealed and exposed supply and outdoor air.

1. Indoor, concealed and exposed return located in non-conditioned non-plenum space.

- 2. Indoor, exhaust between isolation damper and penetration of building exterior.
- 3. Outdoor, exposed supply and return. B. Items Not Insulated:

- 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
- 2. Factory-insulated flexible ducts.
- 3. Factory-insulated plenums and casings.
- 4. Flexible connectors.
- 5. Vibration-control devices.
- 6. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75lb/cu. ft. nominal density.

- A. Exposed (in finished spaces), Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 11/2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Concealed, Outdoor Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.
- C. Exposed in Unconditioned Spaces or Mechanical Rooms, Supply-Air, Return-Air, and Outdoor Air Duct and Plenum Insulation: Mineral-fiber board, 1 inches thick and 3-lb/cu. ft. nominal density.
- D. Concealed or Exposed Exhaust and Relief Between Isolation Damper and Penetration of Building Exterior, and Within 20' of the Building Exterior: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. ft. nominal density.
- E. Kitchen Hood exhaust ducts shall be insulated with minimum 2-hour rated grease duct wrap.

3.12 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

A. Exposed, Supply-Air and Return-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb/cu. ft. nominal density.

3.13 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

- C. Circuit Setters: Insulate with pre-formed insulation sections specifically designed for the specific circuit setters, and adjacent piping insulation and jacketing shall butt to same, and be sealed. D. Heat-Exchangers Insulation: Removable insulation covers.
- E. Heating-Hot-Water Pump Insulation: Mineral-Fiber Board/Pipe and Tank: 2 inches thick and 3lb/cu. ft. nominal density.
- F. Chilled-water air-separator insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Pipe and Tank: 1 inch thick.
- G. Re-heat Coils: VAV and FPVAV reheat coil sections shall have field installed insulation, coving the exposed coil u-bends on both sides of the coil section, coil headers, and the entire reheat section.
- H. See 3.19 through 3.22 below also.
- **3.14** PIPING INSULATION SCHEDULE, GENERAL
 - A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
 - B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.

3.15 INDOOR PIPING INSULATION SCHEDULE

- A. Chilled Water and Refrigerant Suction: Insulation shall be one of the following:
 - 1. Flexible Elastomeric
 - 2. Mineral-Fiber, Preformed Pipe, Type I
- B. Heating-Hot-Water Supply and Return: Insulation shall be:
 - 1. Mineral-Fiber, Preformed Pipe, Type I
- C. Exposed Hot-Gas Piping. Insulation shall be:
- 1. Mineral-Fiber, Preformed Pipe, Type I
- D. Low Pressure Steam and Steam Condensate: Insulation shall be:

- 1. Mineral-Fiber, Preformed Pipe, Type I
- E. HP Steam and Steam Condensate: Insulation shall be: 1.

Mineral-Fiber, Preformed Pipe, Type I

- F. Pipe insulation subject to maintenance personnel traffic or within 60" of the floor in mechanical type spaces shall be minimum 12 pcf density (with a maximum conductivity of 0.45 BTU inch/(hr-sf-F) at 100°F) and is to be PVC (30 mil thick Series 300) or metal jacketed with waterproof seams and joints. Thicknesses to be as follows (thickness derived normally from ASHRAE 90.1-2007/required thickness): (1"/2").
- G. Cooling Coil Condensate Piping
- H. Condenser Water Piping: No Insulation Required.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE [EOR TO FINAL DETERMINE ALL DEPENDING ON CAMPUS, IN-FORCE ASHRAE 90.1 VERSION, IN-FORCE IMCC VERSION, ETC]

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field applied jacket over the factory-applied jacket. B. Piping, Exposed:

- 1. PVC: Minimum 20 mils thick.
- 2. Aluminum, Smooth or Corrugated or Stucco Embossed: Minimum 0.016 inch thick.

3.17 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE [EOR TO FINAL DETERMINE ALL DEPENDING ON CAMPUS, ETC]

- A. Chilled Water and Refrigerant Suction: Insulation shall be one of the following:
 - 1. Flexible Elastomeric
 - 2. Mineral-Fiber, Preformed Pipe, Type I

3.18 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the fieldapplied jacket over the factory-applied jacket. Installation to be waterproof.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Smooth or Corrugated or Stucco Embossed: Minimum 0.016 inch thick.

- D. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Aluminum, Smooth or Corrugated or Stucco Embossed: Minimum 0.032 inch thick. E.

Piping, Exposed:

- 1. PVC: 30 mils thick.
- 2. Aluminum, Smooth or Corrugated or Stucco Embossed: Minimum 0.016 inch thick.

3.19 REMOVABLE INSULATION COVERS

A. Use to cover steam valves, chilled water valves, heating hot water valves, steam expansion joints, condensate pump package receivers, heat exchanger faces, flash tanks, hurling tanks and similar vessels, and awkward surfaces not covered by insulation.

3.20 COLD HYDRONIC PUMP INSULATION

A. Each pump to be covered by minimum of 1" thick AP Armaflex (or thicker to eliminate condensation) applied with a waterproof adhesive. Removable components shall use Velcro applied to both the pump body and the insulation with waterproof adhesive such that pieces can be removed for servicing and inspection and re-installed without damage.

3.21 HOT PUMP INSULATION

A. Each pump to be covered by minimum of 1" thick fiberglass pipe and tank insulation applied with a high temperature adhesive and finish jacketing and banding/wiring. Removable components shall use Velcro applied to both the pump body and the insulation with high temperature adhesive such that pieces can be removed for servicing and inspection and reinstalled without damage.

3.22 CHILLER INSULATION

A. Each chiller to be covered by minimum of 1" thick AP Armaflex (or thicker to eliminate condensation) applied with a waterproof adhesive. Removable components shall use Velcro applied to both the pump body and the insulation with waterproof adhesive such that pieces can be removed for servicing and inspection and re-installed without damage.

3.23 CONVERTOR INSULATION

- A. Each convertor to be covered by removable insulation covers such that pieces can be removed for servicing and inspection and re-installed without damage (for heat exchanger face only).
- 3.24 INSULATION FOR STEAM AND CONDENSATE PIPING

- A. Provide piping and equipment insulation as manufactured by Owens-Corning, CertainTeed, Knauf, or John Manville or as indicated. Insulation shall be UL listed with flame spread / fuel contributed/ smoke developed rating of 25/50/50 in accordance with ASTM E84, NFPA 90A, NFPA 255 and UL 723.
- B. Low pressure condensate return piping shall be insulated with Owens Corning SSL-II fiberglass pipe insulation with factory applied all service vapor barrier jacketing. Provide PVC pipe fittings filled tightly with fiberglass. Insulation K factor shall be minimum of 0.23 at 75°F per ASTM C335.
- C. High pressure steam and condensate return piping within buildings shall be insulated with 1200°F rated mineral wool piping insulation ASTM-C547 with factory vapor barrier jacket.
- D. Provide stainless steel jacketing over factory vapor barrier covering for all piping in the vaults for entire straight lengths and jacket over PVC elbow and valve covers. Refer to specification of stainless steel coverings below. Insulation K factor shall be minimum of 0.23 at 75°F per ASTM C335. Thickness shall be 1.5" for piping up to 4" and 2" thick for piping 5" and larger. Provide calcium silicate 120° segment at points of support (under insulation protection shield). Insulation protection shield shall be installed over stainless steel jacketing.
- E. High pressure steam and condensate return piping within vaults shall be insulated using IIG (Industrial Insulation Group, LLC) thermo-12 gold pre- formed, 1200°F rated pipe and block insulation composed of hydrous calcium silicate which is inorganic, non-combustible, and meets ASTM C533 and ASTM C411, Type 1. Thermal conductivity shall be 0.45 btu*in/(hr*ft*°f)at 300°F. Cover all insulated piping and fittings withing vault with stainless steel jacketing (see below).

Fluid design operating	Nominal pipe diameter (in.)				
temperature range, r	<	1" to $< 1\frac{1}{2}$ "	$1\frac{1}{2}$ " to < 4"	4" to < 8"	8" & up
	1"				
Above 350°	4.5	5.0	5.0	5.0	5.0
251°-350°	3.0	4.0	4.5	4.5	4.5
201°-250°	2.5	2.5	2.5	3.0	3.0
100°-200°	1.5	1.5	2.0	2.0	2.0
40°-60°	1.5	1.5	1.5	1.5	1.5
Up to 39°	1.5	1.5	2.0	2.0	2.0

1. Insulation thicknesses shall be as follows:

The table is based on ASHRAE 90.1-2013 and IMCC-2012. Insulation for pipe service 40-60F and <40F exceeds the requirements of ASHRAE 90.1 and IECC for condensation purposes.

- F. If physical constraints will not allow the above thicknesses to be installed, contractor shell provide an equivalent insulating value thickness of Pyrogel XTF. Cover insulation with minimum 2 coats of wettable fabric.
- G. Insulation shall be applied using manufacturer approved material and methods. Adhesives shall be waterproof retardant type in compliance with ASTM E84, NFPA 255 and UL 723.
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- H. No insulation shall be applied until after the system has been properly tested in presence of owner's representative. Ductwork shall be sealed, tested and proved air tight prior to insulation application.
- I. No piping shall be insulated until pressure testing has been completed and accepted by the owner.
- J. Insulate all valves and pipe fittings except omit insulation on the following: unions, traps and strainer blow-off valves.
- K. Pipe fittings shall be covered with same thickness of insulation as the pipe and wrapped with wettable cloth fabric and sealed with approved adhesive.
- L. Equipment to be insulated shall include all equipment which is a part of the piping system. Such includes but is not limited to: flash tanks.
- M. New and existing insulated piping within manholes shall be enclosed with 304 stainless steel jacket with prefabricated stainless steel fitting covers. Jacket shall be provided with stainless steel straps at 12" O.C. seams shall be arranged to shed water, shall overlap shall be caulked with weather resistant industrial quality clear sealant. Jacket thickness shall be 0.16" up to 6" O.D. (including insulation) and 0.20" thick for piping with O.D. greater than 6". Metal jacketing shall be by ITW (ITWINSINSULATIONS.COM) or equal. Cover all valves and fittings located outside with same insulation type and thickness as piping. Installed custom fabricated or prefabricated valve jacketing covering entire valve and leaving only operating handle. Seal water tight with mastiques and sealant such that no insulation can become wet. Aluminum jacketing and PVC covers within manholes are not acceptable. Use of PVC covers within manholes is prohibited.
- N. PVC fitting covers (see below) shall be used in mechanical rooms.
- O. PVC factory insulation fitting and straight pipe covers for pipe fittings and valves: proto "Losmoke" fabricated of ASTM 1784 polyvinyl chloride. 160°F rated with 25/50 fire/smoke rating per ASTM E-84, bright gloss white. Fitting covers shall be commercial grade thickness. "light gauge" commercial thickness covers are not acceptable. Install covers using manufacturerfurnished adhesive mastic and sealant. Contractor shall use cover manufacturer furnished fiberglass insulation inserts for each specific application with fiberglass having k=0.26 at 75°F per ASTM C177. All fitting covers shall be one-piece. Space between PVC covers and piping shall be filled tightly with insulation.
- P. Cover thickness shall be as follows:
 - 1. Circumference including overlap up to 9", cover thickness 0.020
 - 2. Circumference including overlap up to 9.5" to 13", cover thickness 0.030.
 - 3. Circumference including overlap up 14" and larger, cover thickness 0.040
- Q. When connecting new piping to existing piping within manhole existing insulation covering entire straight run of pipe to which new piping connects shall be stripped of the existing insulation and new insulation and jacketing in accordance with the specification shall be provided to the entire straight piece of existing pipe to which new pipe connects.

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- R. Where anchor is installed in the existing piping in the existing manhole, the straight run of pipe to which anchor is installed shall be stripped of existing insulation and new insulation and jacketing in accordance with the specification shall be provided to straight pipe.
- S. Valves shall be insulated entirely leaving only stem and handle. Valves shall be operable without disturbing insulation. Should the insulating contractor notice that the valves installed by mechanical contractor cannot be properly insulated due to lack of extended handle, insulating contractor shall not insulate such valves until proper size handle has been installed by mechanical contractor. Do not insulate pipe unions and steam traps. Provide neat 45 degree taper at each side of union or trap.
- T. Insulation shall be sealed with manufacturer's approved sealant and shall have neat finished appearance. No exposed insulation shall be visible.
- U. At wall penetrations by high pressure steam piping provide calcium silicate ASTM C533 rigid white insulation

END OF DOCUMENT 23 07 00

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with ASHRAE 15 (latest edition), "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5 (latest edition), "Refrigeration Piping & Heat Transfer Components."
- C. UL 207 Refrigerant Containing Components and Accessories.

1.4 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.5 INSTALLATION

- A. Provide filter/dryer assemblies, moisture indicators, thermal expansion valve and solenoid valves for each refrigeration circuit.
- B. Pressure test refrigerant piping system at 300 psi for high side and 150 psi for low side. Maintain pressure for a minimum of 24 hours.

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- C. Leak test piping and joints with an electronic or halide leak detector.
- D. Evacuate entire system with an approved high vacuum pump system to 500 microns.

PART 2 - PRODUCTS

- 2.1 COPPER TUBE AND FITTINGS
 - A. Copper Tube: ASTM B 280, Type ACR.
 - B. Wrought-Copper Fittings: ASME B16.22.
 - C. Wrought-Copper Unions: ASME B16.22.
 - D. Brazing Filler Metals: AWS A5.8.
- 2.2 VALVES AND SPECIALTIES
 - A. To be per Manufacturer's instructions including but not limited to the following:
 - 1. Moisture/Liquid Indicators:
 - 2. Replaceable-Core Filter Dryers: Comply with ARI 730.
 - 3. Permanent Filter Dryers: Comply with ARI 730.
 - 4. Liquid Accumulators: Comply with ARI 495.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction Lines, Hot Gas and Liquid Lines All Sizes to be Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wroughtcopper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install all valves and specialties per manufacturer's instructions.
- 3.3 PIPING INSTALLATION
 - A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate

friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. 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.

- O. 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.
- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Insulate suction lines with 1.5" of flexible elastomeric insulation, and weather-proof same outdoors with two coats of insulation manufacturer's weather-proofing coating. Refer to Section 230719 for further general requirements pertaining to pipe insulation.
- Q. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in applicable Division 23 Section. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in applicable Division 23 Section. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in applicable Division 23 Section.

3.4 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." B. Install the following pipe attachments:

- 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
- 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
- 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
- 4. Spring hangers to support vertical runs.
- 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch. D. Support

multi-floor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Piping shall be evacuated, tested, adjusted, and charged in strict accordance with the equipment manufacturer's instructions.

END OF DOCUMENT 23 23 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Book Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Double-wall rectangular ducts and fittings.
 - 3. Single-wall round and flat-oval ducts and fittings.
 - 4. Double-wall round and flat-oval ducts and fittings.
 - 5. Laboratory exhaust ductwork.
 - 6. Sheet metal materials.
 - 7. Duct cleaning and contamination protection.
 - 8. Sealants and gaskets.
 - 9. Hangers and supports. B. Related Sections:
 - 1. Section 23 0529 "Mechanical Supporting Devices."
 - 2. Section 23 0550 "Vibration Isolation."
 - 3. Section 23 0553 "Mechanical Systems Identification."
 - 4. Section 23 0594 "Testing, Adjusting, and Balancing (TAB)."
 - 5. Section 23 0700 "Mechanical System Insulation."
 - 6. Section 23 3314 "Ductwork Specialties" for dampers, sound-control devices, ductmounting access doors and panels, turning vanes, flange connectors, flexible connectors, duct accessory hardware, louvers, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated in the "Duct Schedule" Article and on the drawings.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. SMACNA's 3rd Edition, 2005, "HVAC Duct Construction Standards Metal and Flexible," as referenced herein.

1.4 ACTION SUBMITTALS/INFORMATION

- A. Product Data: For each type of the following products:
 - 1. Factory fabricated ductwork and fittings.
 - 2. Factory fabricated hangers and supports.
 - 3. Transverse joint components.
 - 4. Sealants and gaskets.
- B. Delegated-Design Information (for Contractor Use and University Reference, Not For Engineer Approval) :
 - 1. Sheet metal thicknesses.
 - 2. Joint and seam construction and sealing.
 - 3. Reinforcement details and spacing.
 - 4. Materials, fabrication, assembly, and spacing of hangers and supports.
 - 5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.
- 1.5 INFORMATIONAL SUBMITTALS (For Use Amongst the Contractors and For Owner Reference, Not For Engineer Approval)
 - A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 3. Factory and shop fabricated ducts and fittings.
 - 4. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 5. Elevation of tops or bottoms of ducts.
 - 6. Dimensions of main duct runs from building grid lines.
 - 7. Fittings.
 - 8. Reinforcement and spacing.
 - 9. Seam and joint construction.
 - 10. Penetrations through fire-rated and other partitions.
 - 11. Equipment installation based on equipment being used on Project.
 - 12. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 13. Hangers and supports, including methods for duct and building attachment and vibration isolation.
 - 14. Suspended ceiling components.
 - 15. Structural members to which duct will be attached.
 - 16. Size and location of initial access modules for acoustical tile.

- 17. Penetrations of smoke barriers and fire-rated construction.
- 18. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings. B. Welding certificates.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code Aluminum," for aluminum supports.
 - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 "HVAC System Construction and Insulation."
- 1.7 SPECIAL WARRANTIES
 - A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 FIBROUS GLASS (DUCTBOARD) DUCTS A.

Not allowed.

- 2.2 LINED DUCTWORK
 - A. Not allowed.
- 2.3 ELBOWS, TRANSITIONS, OFFSETS, BRANCH CONNECTIONS, LATERALS, AND OTHER DUCT CONSTRUCTION REQUIREMENTS

A. Fabricate and install all duct fittings, branches, inlets, outlets, transitions, take-offs, laterals, offsets, and elbows to minimize air turbulence and resistance and to ensure proper airflows. B. Extractors and splitter dampers not allowed.

- C. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible," Chapters 3 and 4, for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible." But:
 - 1. Mitered elbows with turning vanes not permitted, use radius elbows.
 - 2. Radius elbows shall have minimum centerline radius to width or diameter ratio of 1.5. If 1.5 ratio elbows do not fit, use 1.0 radius elbows. Where 1.0 radius elbows do not fit, use square throat elbows with turning vanes.
 - 3. Pleated or adjustable elbows not allowed.
 - 4. No straight taps, branch or lateral take-offs, or connections, all to be expanded or conical, and taken off at an angle < 90° if possible.
 - 5. No bullhead tees for either diverging or converging flow.
 - 6. For transitions, where the shape of the duct changes, ensure the angle of the side of the transition piece does not exceed 15° from the straight run of duct connected thereto. Where equipment is installed in the ductwork, ensure the angle of the side of the transition piece from the straight run of duct connected thereto does not exceed 15° on the upstream side of the equipment and 22.5° on the downstream side of the equipment.
 - 7. Special duct branch requirements: Where a duct branch handles over 25% of the air transported by the duct main, use a complete 90° increasing elbow, with an inside radius of 0.75 times the duct branch width. Ensure the size of the trailing end of the increasing elbow within the duct main is in the same ratio to the main duct size as the ratio of the relative air quantities being handled. Where a duct branch is to handle 25% or less of the air handled by the duct main, provide a branch connection with an inside radius of 0.75 times the branch duct width, a minimum arc length of 45°, and an outside radius of 1.75 times the duct branch width. Place arc tangent to the duct main.
 - 8. Saddle taps are not allowed on new or existing ducts.
 - 9. See more information and requirements in PART 3 herein.

2.4 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated. But, duct wall thickness to be minimum 22 gage except where any welding other than longitudinal seams is performed, then the minimum thickness shall be 18 gage, and, no crimp joints allowed.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support

intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." But, transverse (girth) joints T-4, 9, 17 through 20, and 23 not permitted.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." But, button punch snaplock seams are not permitted.

2.5 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. McGill AirFlow LLC.
 - 2. SEMCO.
- B. General Fabrication Requirements: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated. Duct wall thickness to be minimum 22 gage except where any welding other than longitudinal seams is performed, then the minimum thickness shall be 18 gage.
- C. Contractor Fabricated Ductwork: Ductwork of this section (2.5) may be fabricated by the contractor if it can be demonstrated that it meets or exceeds the performance of the manufacturer's products listed directly above.
- D. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct. But, duct wall thicknesses to be minimum 22 gage except where any welding other than longitudinal seams is performed, then the minimum thickness shall be 18 gage.
- E. Outer Duct: Comply with SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- F. Transverse Joints: Select joint types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." But, transverse (girth) joints T-4, 9, 17 through 20, and 23 not permitted.
- G. Longitudinal Seams: Select seam types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." But, button punch snaplock seams are not permitted.
- H. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

- 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F mean temperature.
- 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
- 3. Coat insulation with antimicrobial coating.
- 4. Cover insulation with polyester film complying with UL 181, Class 1.
- 5. Insulation Thickness: See PART 3.
- I. Inner Duct: Minimum 0.028-inch thick solid sheet galvanized steel.
- J. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." But, transverse (girth) joints T-4, 9, 17 through 20, and 23 not permitted.

2.6 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated but, only spiral seam or fully welded longitudinal seam duct is to be used. And, longitudinal seam ductwork not to be used if exposed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGill AirFlow LLC.
 - b. SEMCO Incorporated.
 - c. Spiral Manufacturing Co., Inc.
- B. Contractor Fabricated Ductwork: Ductwork of this section (2.6) may be fabricated by the contractor if it can be demonstrated that it meets or exceeds the performance of the manufacturer's products listed directly above.
- C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension). SMACNA Type 1 reinforcement (Figure 3-6 of SMACNA's Duct Construction Standards) is not allowed.
- D. Transverse Joints: Select joint types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." But, no crimp joints allowed.
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for

static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." But, snaplock seams not allowed.

- 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
- 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with buttwelded longitudinal seams.

2.7 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated staticpressure class unless otherwise indicated but, only spiral seam or fully welded longitudinal seam duct is to be used. And, longitudinal seam ductwork not to be used if exposed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGill AirFlow LLC.
 - b. SEMCO Incorporated.
 - c. Spiral Manufacturing Co., Inc.
- B. Contractor Fabricated Ductwork: Ductwork of this section (2.7) may be fabricated by the contractor if it can be demonstrated that it meets or exceeds the performance of the manufacturer's products listed directly above.
- C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct. SMACNA Type 1 reinforcement (Figure 3-6 of SMACNA's Duct Construction Standards) is not allowed.
- D. Outer Duct: Comply with SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
- E. Transverse Joints: Select joint types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." And, no crimp joints allowed.
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- F. Longitudinal Seams: Select seam types and fabricate according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals,

and other provisions in SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible." But, no snaplock seams allowed.

- 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
- 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with buttwelded longitudinal seams.
- G. Inner Duct: Minimum 0.028-inch thick solid sheet steel. Factory fabricated, insulated round duct to be McGill Airflow, Acoustic K-27, or approved equal by SEMCO or Spiral Manufacturing Co., Inc.
- H. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Thickness for ducts inside the building minimum 1.5", 3" thickness for ducts outside.

2.8 LABORATORY EXHAUST DUCTWORK

- A. Ductwork and shall be all welded Type 316 stainless steel, minimum 18 gage.
- 2.9 SHEET METAL MATERIALS
 - A. General Material Requirements: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Duct wall thickness to be minimum 22 gage except where any welding other than longitudinal seams is performed, then the minimum thickness shall be 18 gage.
 - B. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
 - C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90 (Z275).
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
 - D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316 (Type 316 only for Lab exhaust), as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
 - E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

- F. Reinforcement Shapes and Plates for Galvanized Ducts: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black and galvanized-steel shapes and plates are used to reinforce aluminum or stainless steel ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- G. 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.

2.10 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL. B. Water-Based Joint and Seam Sealant:

- 1. Application Method: Brush on.
- 2. Solids Content: Minimum 65 percent.
- 3. Shore A Hardness: Minimum 20.
- 4. Water resistant.
- 5. Mold and mildew resistant.
- 6. VOC: Maximum 75 g/L (less water).
- 7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
- 8. Service: Indoor or outdoor.
- 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Solvent-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Base: Synthetic rubber resin.
 - 3. Solvent: Toluene and heptane.
 - 4. Solids Content: Minimum 60 percent.
 - 5. Shore A Hardness: Minimum 60.
 - 6. Water resistant.
 - 7. Mold and mildew resistant.
 - 8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 9. VOC: Maximum 395 g/L.
 - 10. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
 - 11. Service: Indoor or outdoor.
 - 12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint (SMACNA Joints T-24, T-25, and proprietary slip-on flanges) Sealant: Comply with ASTM C 920.

- 1. General: Single-component, acid-curing, silicone, elastomeric.
- 2. Type: S.
- 3. Grade: NS.
- 4. Class: 25.
- 5. Use: O.
- 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Pressure Sensitive Tapes for Primary Sealing of Ducts: Not allowed.
- G. Duct Sealer Manufacturers/Products: United Airseal United Duct Seal, Mon-Eco Industries 44/48, or Foster 32.
- H. Lab Exhaust Duct/System Sealant: For any non-welded joints or connections, sealants shall be custom selected for the duty, including proper chemical resistance against whatever is to be transported in the duct system.

2.11 HANGERS AND SUPPORTS

- A. Shall be in accordance with SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible" except non-engineered wire hangers are not permitted. Engineered cable support systems may be used if they meet SMACNA, Ductmate or approved equal.
- B. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- C. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- D. Strap and Rod Sizes: Comply with SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- E. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- F. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- G. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- H. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- I. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

- 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
- 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

- 3.1 DUCT INSTALLATION
 - A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
 - B. Install ducts according to SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
 - C. Install round ducts in maximum practical lengths.
 - D. Install ducts with fewest possible joints.
 - E. Install factory or shop fabricated fittings for changes in direction, size, and shape and for branch connections.
 - F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
 - G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
 - H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
 - I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
 - J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
 - K. Where ducts pass through fire and/or smoke and/or fire/smoke rated surfaces, install appropriate safety dampers. Comply with requirements in Section 23 3314 "Duct Specialties" for safety dampers.
 - L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.
- 3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT
 - A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
 - B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 10 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.
 - C. Install access openings at each change in direction and at intervals defined by NFPA 96; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with grease-tight fire rated covers of same material as duct.
 - D. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING AND CONTAMINATION PROTECTION

- A. Contamination Protection: Ductwork shall be sealed at the point of fabrication/manufacture, and remain sealed until installed. Ductwork must be sealed at all times, even if being worked on. Seals can be removed only during immediate installation and must be restored immediately upon non-work activity. Ductwork being worked on shall be sealed at the end of each work day.
- B. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible."
- C. Seal all ducts to Seal Class A according to SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 52, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection. D. Hangers Exposed to View: Threaded rod and angle or channel supports.

- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 3314 "Duct Specialties."
- B. Comply with SMACNA's 2005 "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections, and see drawings/details.

3.7 PAINTING

A. Prime and paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

- 1. Leakage tests shall be conducted in accordance with 1985, 1st Edition, of SMACNA's "HVAC Air Duct Leakage Test Manual," Sections 3 and 5. Positive pressure ductwork to be tested under positive pressure. Negative pressure ductwork to be tested under positive and negative pressure. Submit a test report for each test.
- 2. Test the following systems:
 - a. Supply Ducts with a Pressure Class of 3-Inch wg (750 Pa) or Higher: Test representative duct sections, selected by Engineer from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - b. All Lab exhaust ductwork.
- 3. Leakage tests to be witnessed by the University.
- 4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
- 5. Test for leaks before applying external insulation and before ducts are concealed.
- 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
- 7. Give seven days' advance notice for testing.
- 8. Leakage shall not exceed the values in the following Table 23-3114-3:

Table 23-3114-3 – Allowable Leakage Rates, cfm/100 ft ² Surface Area				
Location	Test Pressure in. wg	Rectangular Ductwork	Round Ductwork	Flat Oval Ductwork
Low Pressure Ductwork ^a	2	9.4	4.7	4.7
All Other Ductwork⁵	4	14.8	7.4	7.4

^{a.} Supply Ductwork: Ductwork downstream of VAV/CAV Terminals, Return Ductwork: Ductwork upstream of VAV/CAV Terminals.

^{b.} Supply, Return, and Exhaust Ductwork C. Duct System

Cleanliness Tests:

- 1. Visually inspect duct system to ensure that no visible contaminants are present.
- Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Clean existing ducts 10' each direction which become open due to equipment or duct removal, and clean before testing, adjusting, and balancing. C. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 3314 "Duct Specialties" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process. D.

Particulate Collection and Odor Control:

- 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
- 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- E. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums, scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, condensate drain pans, humidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6. Supply-air ducts, dampers, actuators, and turning vanes. F. Mechanical Cleaning

Methodology:

- 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
- 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
- 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
- 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
- 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
- 6. Provide drainage and cleanup for wash-down procedures.
- 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with project TAB requirements.

END OF DOCUMENT 23 31 13

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Fire dampers.
 - 4. Smoke dampers.
 - 5. Combination fire/smoke dampers.
 - 6. Flange connectors.
 - 7. Turning vanes.
 - 8. Duct-mounted access doors and panels.
 - 9. Flexible connectors.
 - 10. Flexible ducts.
 - 11. Duct accessory hardware.
 - 12. Louvers.
 - 13. Duct Sound Attenuators.

1.2 SUBMITTALS

A. Product and Technical Data: For each type of product indicated, including (but not limited to) installation requirements, dimensions, color charts and water penetration data for louvers, wiring diagrams, dynamic insertion loss and self-noise data for attenuators, and air pressure drop information.

B. [LEED Submittals:

- 1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2007, Section 5 "Systems and Equipment."
- 2. Any data that can be used for recycled content and regional materials credits.]
 - C. Operation and maintenance data.
- D. Northwestern University Maintenance Requirement Forms, see Division 01.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating, and with AMCA 500-L for louver performance.
- C. For louver finishes, comply with applicable SSPC and AAMA requirements.

- D. For duct sound attenuators, they shall be tested in accordance with ASTM E-477-99 silencer test standard in a certified test facility which is NVLAP accredited for the testing.
- 1.4 SPECIAL WARRANTIES
 - A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

- 2.1 MATERIALS
 - A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
 - B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Exposed-Surface Finish: Mill phosphatized.
 - C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 except for Lab exhaust, which shall be Type 316.
 - D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
 - E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6, except for louvers, which are to be Temper T5.
 - F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
 - G. 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 DAMPERS BACKDRAFT, VOLUME, FIRE, SMOKE, FIRE/SMOKE
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Balance.
 - 2. Cesco.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. Prefco (Basis of Design) 6. Ruskin Company.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Description: Gravity balanced.
- B. Maximum Air Velocity: 3000 fpm.
- C. Maximum System Pressure: 2-inch wg.
- D. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners.
- E. Blades: Multiple single-piece blades, maximum 6-inch width with sealed edges.
- F. Blade Action: Parallel.
- G. Return Spring: Adjustable tension.
- H. Bearings: Provide end bearings on all dampers. On multiple blade dampers bearing shall be oilimpregnated nylon or sintered bronze. I. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Material: Galvanized steel.
 - 6. Screen Type: Bird.
 - 7. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

- 1. Show dampers on Drawings.
- 2. Damper and blade material to match ductwork material
- 3. Standard leakage rating.
- 4. Suitable for horizontal or vertical applications.
- 5. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 6. Blades:
 - a. Rectangular dampers shall be single blade type in ducts up to 11" high and shall be opposed blade type in ducts 12" high and above.
 - b. Round dampers shall be single blade type.
 - c. Stiffen damper blades for stability.

- 7. Provide end bearings on all dampers. On multiple blade dampers bearing shall be oilimpregnated nylon or sintered bronze.
- 8. Provide locking indicating quadrant regulators on all dampers. Where rod lengths exceed 30-inches, provide a regulator at both ends.
- 9. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- 10. Jackshaft:
 - a. Size: 1-inch diameter.
 - b. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - c. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- 11. Damper Hardware:
 - a. 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.
 - b. Include center hole to suit damper operating-rod size.
 - c. Include elevated platform for insulated duct mounting.

2.5 FIRE DAMPERS

- A. Fire dampers shall be dynamic, multiple airfoil blade type (not curtain type) with integral wall sleeve, constructed in accordance with UL Standard 555.
- B. Closing rating in ducts up to 8-inch wg static pressure class and minimum 4000-fpm velocity.
- C. Dampers shall be for horizontal or vertical mounting and shall be of sizes shown on the drawings.
- D. Dampers shall have 1-1/2 or 3 hour rating as shown on drawings, replaceable 212 degree F fusible link, and access panels (with UL 181 rated viewports), for installation on both sides of damper.

2.6 SMOKE DAMPERS

- A. General Requirements: Label according to UL 555S by an NRTL.
- B. Smoke Detector: Integral, factory wired for single-point connection.
- C. Frame: Multiple blade type (not curtain type); fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners. D. Blades: Airfoil, multiple.
- E. Leakage: Class III, and, all seals to be metal-to-metal.

- F. Rated pressure and velocity to exceed design airflow conditions, and dampers to be rated for 4,000 fpm and 8" pressure minimum.
- G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- H. Damper Motors: Modulating action, electric.
- I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Motors."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 25 Section "Integrated Automation
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.

J. Dampers shall be supplied/installed with access panels (with UL 181 rated viewports), for installation on both sides of damper. K. Accessories:

- 1. Auxiliary switches for [signaling] [fan control] [or] [position indication].
- 2. [Momentary test switch] [Test and reset switches], [damper] [remote] mounted.

2.7 COMBINATION FIRE/SMOKE DAMPERS

- A. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL, multiple blade, not curtain type. Basis of Design Prefco Model 5010.
- B. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm velocity.
- C. Fire Rating: 3 hours.
- D. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.

- E. Heat-Responsive Device: Reusable electric "McCabe™" link, with an external manual reset lever (see drawing details). The releasing device shall be 24Vdc in compliance with UL 873. The resettable link shall be 280°F, and UL 33 listed. F. Smoke Detector: Furnished by electrical.
- G. Blades: Roll-formed, horizontal, interlocking, minimum 0.034-inch- thick, galvanized sheet steel.
- H. Leakage: Class I
- I. Rated pressure and velocity to exceed design airflow conditions.
- J. Mounting Sleeve: Factory-installed, minimum 0.05-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- K. Master control panel for use in dynamic smoke-management systems.
- L. Damper Motors: two-position action.
- M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 0513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 25.
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - Non-spring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - 7. Electrical Connection: 24 or 115 V as called for by control systems specifications, sequences, or on drawings, and as required, single phase, 60 Hz, and as coordinated with electrical contractor.
- N. Accessories:
 - 1. Auxiliary switches for signaling or position indication.
 - 2. Test and reset switches, remote mounted.
 - 3. Access panels (with UL 181 rated viewports), for installation on both sides of damper.
 - 4. Other as required.

2.8 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.
- 2.9 TURNING VANES
 - A. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
 - B. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.
- 2.10 DUCT-MOUNTED ACCESS DOORS
 - A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular, and 24" x 24" or as close to 24" x 24" as possible.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - d. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches

2.11 DUCT ACCESS PANEL ASSEMBLIES

- 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. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.12 FLEXIBLE CONNECTORS

- A. Manufacturer: Ventfabrics, Model Ventglas.
- B. Materials: Flame-retardant or non-combustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Material shall be crimped into a metal edging strip and shall be approximately 3 inches wide.
- E. Indoor System, Flexible Connector Fabric: Minimum 0.024 " thick glass fabric double coated with neoprene.
 - 1. Minimum Weight: 30 oz./sq. yd..
 - 2. Tensile Strength: Minimum 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Minimum 0.024" thick glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 30 oz./sq. yd..
 - 2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.

2.13 FLEXIBLE DUCTS

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. Casco.
- 2. Flexmaster U.S.A., Inc., Type 6.
- 3. Thermaflex, Model M-KE.
- B. Non-insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, springsteel wire.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, springsteel wire; fibrous-glass insulation; fire resistive vapor-barrier film.
 - 1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 175 deg F.
 - 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1-2007.
- D. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; fire resistive vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 20 to plus 210 deg F.
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2007. E. Flexible Duct

Securement:

1. Clamps: Stainless-steel band with hex screw to tighten band with a worm-gear action or Nylon strap in sizes 3 through 18 inches, to suit duct size.

2.14 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.
- 2.15 LOUVERS
 - A. Horizontal, Drainable-Blade Louvers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of MESTEK, Inc.
 - b. Airolite Company, LLC (The), Basis of Design, Model K6856.
 - c. Cesco Products; a divsion of MESTEK, Inc.
 - d. Greenheck Fan Corporation.
 - e. Ruskin Company.
- 2. Louver Depth, Blade Angle, and Free Area: 6 inch depth, blades at 45° angle, and minimum free area of 49.4%.
- 3. Frame and Blade Materials of Construction and Nominal Thickness: Not less than 0.081 inch, and constructed of ASTM B221 aluminum extrusions, Alloy 6063-T5.
- 4. Fabrication: Welded.
- 5. Frame Type:
- 6. Sill Type: Extended.
- 7. Mullion Type: Exposed.
- 8. Sleeve: Minimum 16 gage galvanized steel, by contractor.
- 9. Size and performance data: See schedules/drawings.
- 10. Finish: 2-coat, oven cured Kynar 500, 2.0 mils dry film coating thickness per AAMA 2605.
- 11. Louver Performance Ratings:
 - a. Free Area: Not less than 7.9 sq. ft. for 48-inch wide by 48-inch high louver.
 - b. Point of Beginning Water Penetration: Not less than 1065 fpm.
 - c. Air Performance: Not more than 0.072-inch wg static pressure drop at 700-fpm freearea intake velocity.
 - d. Air Performance: Not more than 0.17-inch wg static pressure drop at 1000-fpm freearea exhaust velocity.
- 12. Wind Loads: Determine loads based on a uniform pressure acting inward or outward.
- 13. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- 14. Screens: 1/2" aluminum birdscreen finished same as louver.
- 15. Insulated Blank-off Panels.

2.16 DUCT SOUND ATTENUATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Aerocoustic.
 - 2. Aerosonics.
 - 3. Commercial Acoustics, Metalform Corp.
 - 4. Industrial Acoustics.
 - 5. McGill AirFlow LLC.
 - 6. Pottorff/Dynasonics.
 - 7. Ruskin Sound..
 - 8. Semco.

- 9. Vibro-Acoustics.
- B. General Requirements:
 - 1. Factory fabricated.
 - 2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke developed index not exceeding 50 when tested according to ASTM E 84.
 - 3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1. C. Shape:
 - 1. Rectangular straight with splitters or baffles.
 - 2. Round straight with center bodies or pods.
 - 3. Rectangular elbow with splitters or baffles.
 - 4. Round elbow with center bodies or pods.
 - 5. Rectangular transitional with splitters or baffles.
- D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G90 (Z275) galvanized sheet steel minimum 22 ga.
- E. Round Silencer Outer Casing: ASTM A 653/A 653M, G90 (Z275) galvanized sheet steel.
 - 1. Sheet Metal Thickness for Units up to 24 Inches (600 mm) in Diameter: 0.034 inch (0.85 mm) thick.
 - 2. Sheet Metal Thickness for Units 26 through 40 Inches (660 through 1000 mm) in Diameter: 0.040 inch (1.02 mm) thick.
 - 3. Sheet Metal Thickness for Units 42 through 52 Inches (1060 through 1300 mm) in Diameter: 0.05 inch (1.3 mm) thick.
 - 4. Sheet Metal Thickness for Units 54 through 60 Inches (1370 through 1500 mm) in Diameter: 0.064 inch (1.62 mm) thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G90 (Z275) galvanized sheet metal, 0.034 inch (0.85 mm) thick, and with 1/8-inch- (3-mm-) diameter perforations.

G. Special Construction:

- 1. Suitable for outdoor use.
- 2. High transmission loss to achieve STC
- H. Connection Sizes: Match connecting ductwork unless otherwise indicated.
- I. Principal Sound-Absorbing Mechanism:
 - 1. [Select type from 1 and 2]
 - a. Reactive type (No Media) Controlled impedance membranes and broadly tuned resonators without absorptive media.

- b. Dissipative Film-lined type with fill material for Hospital use.
 - 1) Fill Material: Inert and vermin-proof fibrous material
 - 2) Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
 - 3) Lining : Mylar film
- J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
 - 1. Joints: slip or flanged connections.
 - 2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
 - 3. Reinforcement: Cross or trapeze angles for rigid suspension.
- K. Accessories:
 - 1. Factory-installed end caps to prevent contamination during shipping.
- L. Source Quality Control: Test according to ASTM E 477.
 - 1. Testing to be witnessed by Architect
 - 2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm (10-m/s) face velocity.
 - Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6inch wg (1500-Pa) static pressure, whichever is greater. M. Performance and Characteristics: See schedules.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts, and according to manufacturer's instructions/recommendations.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

- 1. Install steel volume dampers in steel ducts.
- 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. All dampers to be accessible and labeled, and are to have at least 24" around them for servicing, adding up to and including valves, actuators, and other devices that need service or need to be accessed to provide service.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated.
- H. Install fire dampers according to UL Listing.
- I. Install combination fire/smoke dampers according to UL Listing.
- J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils and VAV box reheat coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Upstream from manual volume dampers, modulating dampers, backdraft dampers, humidifiers, and equipment.
 - 6. Adjacent to and close enough (and on both sides of) to fire, smoke, and combination fire/smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. Maximum 20-foot spacing.
 - 8. Upstream from turning vanes.
 - 9. Maximum 10-feet from every 90° elbow.
 - 10. Control devices requiring inspection.
 - 11. Up and down stream of airflow measuring stations.
 - 12. Elsewhere as indicated.
- K. Install access doors with swing against duct static pressure.
- L. Access Door Sizes:
 - 1. Hand Access: 24" x 24", or 24" by the duct height/width.
 - 2. Head and Hand Access: 18 by 16 inches.
 - 3. Head and Shoulders Access: 21 by 16 inches.
 - 4. Body Access: 25 by 16 inches.
 - 5. Body plus Ladder Access: 25 by 17 inches.
 - 6. Where fusible links are located, there must be a 24" access panel installed.
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- M. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- N. Install flexible connectors to connect ducts to equipment.
- O. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- P. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- Q. Flexible duct elbows at diffusers are not allowed, elbows at diffusers must be sheet metal, see drawing detail(s).
- R. Connect flexible ducts to metal ducts with draw bands.
- S. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- T. For louvers, use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection. Form closely fitted joints with exposed connections accurately located and secured. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weather-tight louver joints are required. Comply with Section 07 9200 "Joint Sealants" for sealants applied during louver installation.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors/panels and verify that purpose of access doors/panels can be performed.
 - 3. Operate fire, smoke, and combination fire/smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.

END OF DOCUMENT 23 3314

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. For fans in air handling units, refer to project air handling unit section(s) for additional requirements.

1.2 SUMMARY

- A. Section Includes: For each product.
 - 1. Airfoil centrifugal fans.
 - 2. Backward-inclined centrifugal fans.
 - 3. Plenum fans.
 - 4. High Blow Lab Exhaust Fans
 - 5. Fan Arrays.

1.3 REFERENCES

- A. ANSI/AMCA Standards 99-10, 204-05, 300-08, 500-D-12, 500-L-12, and 210-07.
- B. ANSI/AMCA Publications 211-05 and 311-05.
- C. AMCA Standard 260-07.
- D. SMACNA Medium Pressure Plenum Construction Standard.
- E. OSHA Guidelines 1910.212, 1910.219, and 1926.300.
- F. UL 705.
- G. ASHRAE Lab Design Guide.
- H. ANSI/AIHA Z9.5-2012.
- I. ABMA Method of Evaluating Load Ratings of Bearings ANSI-11 (r1999).

1.4 QUALITY ASSURANCE

A. Performance ratings: Conform to applicable ANSI/AMCA Standards 210, 260 and 300. Fans must be tested in accordance with applicable AMCA Publications 211, 260 and 311 in an AMCA accredited laboratory and certified for air and sound performance. Fans shall be licensed to

bear the AMCA ratings seal for air performance (AMCA 210), sound performance (AMCA 300), and induced flow fan for high plume dilution blowers (AMCA 260). Manufacturers that are not licensed to bear the AMCA 210 and 260 ratings seal, must provide performance witness testing (at the manufacturer's expense), per paragraph 1.4.D.

- B. Classification for Spark Resistant Construction shall conform to ANSI/AMCA Standard 99.
- C. Each fan shall be vibration tested before shipping, as an assembly, in accordance with ANSI/AMCA Standard 204. Each assembled fan shall be test run at the factory at the specified fan RPM and vibration signatures shall be taken on each bearing in three planes horizontal, vertical, and axial. The maximum allowable fan vibration shall be less than 0.08 in. /sec peak velocity; filter-in reading as measured at the fan RPM. This report shall be provided at no charge to the customer upon request.
- D. Manufacturers that do not comply with paragraph 1.4.A must also provide, at the owner and engineer's option and manufacturer's expense, witness testing of fan discharge and entrainment airflow, performed in an AMCA accredited laboratory, in accordance with AMCA 210 and 260. This test shall verify the critical and safety related dilution performance of high plume dilution blowers, as stated by the manufacturer.
- E. Comply with FM Global requirements for fans and blowers and for monitoring and diagnosis of vibration in rotating machinery.

1.5 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include rated capacities, furnished specialties, and accessories for each fan.
 - 2. Certified fan performance curves with system operating conditions indicated.
 - 3. Certified fan sound-power ratings.
 - 4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 5. Material thickness and finishes, including color charts.
 - 6. Dampers, including housings, linkages, and operators. B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and restraints and for designing vibration isolation bases.
 - Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- 1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- B. Field quality-control reports.
- 1.7 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.
- 1.8 DELIVERY, STORAGE AND HANDLING
 - A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.
 - B. Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer's instructions. For long term storage, follow manufacturer's Installation, Operation and Maintenance manual.
 - C. Handle and lift fans in accordance with the manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer.
- 1.9 MAINTENANCE MATERIAL SUBMITTALS
 - A. Belts: One set for each belt-driven unit.
- 1.10 SPECIAL WARRANTIES
 - A. Five (5) years, see Division 01.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fan arrays are the standard for the University air handlers, and other fan types for air handling units are considered exceptions.
- B. AMCA Compliance:
 - 1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
 - 2. Operating Limits: Classify according to AMCA 99.

- C. Unusual Service Conditions:
 - 1. Ambient Temperature: 75 °F
 - 2. Altitude: 1027 ft. above sea level.
 - 3. High humidity.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. E. Capacities and Characteristics:

1. See Schedule(s) on Drawings.

2.2 AIRFOIL CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Barry Blower.
 - 2. Howden/Buffalo.
 - 3. Chicago Blower.
 - 4. Greenheck Fan Corporation.
 - 5. Industrial Air.
 - 6. Twin City
- B. Description:
 - 1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
 - 2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
 - 3. Factory-installed and -wired disconnect switch.
- C. Housings:
 - 1. Formed panels to make curved-scroll housings with shaped cutoff.
 - 2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - 3. Horizontally split, bolted-flange housing.
 - 4. Spun inlet cone with flange.
 - 5. Outlet flange.
- D. Airfoil Wheels:
 - 1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange.
 - 2. Heavy backplate.

- 3. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.
- 4. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

E. Shafts:

- 1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
- 2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
- 3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- F. Grease-Lubricated Shaft Bearings:
 - 1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
- G. Grease-Lubricated Shaft Bearings:
 - 1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
 - 2. [Retain "Ball-Bearing Rating Life" or "Roller-Bearing Rating Life" Subparagraph below.] 3. Ball-Bearing Rating Life: ABMA 9, LI0 at 120,000 hours.
 - 4. Roller-Bearing Rating Life: ABMA 11, LI0 at 120,000 hours.
- H. Belt Drives:
 - 1. Factory mounted, with adjustable alignment and belt tensioning.
 - 2. Service Factor Based on Fan Motor Size: 1.5
 - 3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - 4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 5. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
 - 6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamondmesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - 7. Motor Mount: Adjustable for belt tensioning.
- I. Accessories:
 - 1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
 - 2. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
 - 3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 - 4. Inlet Screens: Grid screen of same material as housing.

- 5. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
- 6. Spark-Resistant Construction: AMCA 99.
- 7. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

2.3 BACKWARD-INCLINED CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Barry Blower.
 - 2. Howden/Buffalo.
 - 3. Chicago Blower.
 - 4. Greenheck Fan Corporation.
 - 5. Industrial Air.
 - 6. Twin City
- B. Description:
 - 1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
 - 2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
 - 3. Factory-installed and -wired disconnect switch.
- C. Housings:
 - 1. Formed panels to make curved-scroll housings with shaped cutoff.
 - 2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - 3. Horizontally split, bolted-flange housing.
 - 4. Spun inlet cone with flange.
 - 5. Outlet flange.
 - D. Backward-Inclined Wheels:
 - 1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades, and fastened to shaft with set screws.
 - 2. Welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate.
- E. Shafts:
 - 1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
 - 2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 - 3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

- F. Grease-Lubricated Shaft Bearings:
 - 1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and twopiece, cast-iron housing.
 - 2. [Retain "Ball-Bearing Rating Life" or "Roller-Bearing Rating Life" Subparagraph below.]
 - 3. Ball-Bearing Rating Life: ABMA 9, LI0 at [50,000] [120,000] hours.
 - 4. Roller-Bearing Rating Life: ABMA 11, LI0 at [50,000] [120,000] hours.

G. Belt Drives:

- 1. Factory mounted, with adjustable alignment and belt tensioning.
- 2. Service Factor Based on Fan Motor Size: 1.5
- 3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
- 4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
- 5. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
- 6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamondmesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
- 7. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

- 1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
- Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
- 3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
- 4. Inlet Screens: Grid screen of same material as housing.
- 5. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
- 6. Spark-Resistant Construction: AMCA 99.
- 7. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

2.4 PLENUM FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Barry Blower.
 - 2. Howden/Buffalo.
 - 3. Chicago Blower.

- 4. Greenheck Fan Corporation.
- 5. Industrial Air.
- 6. Twin City B. Description:
- 1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven or direct driven centrifugal fans consisting of wheel, fan shaft, bearings, motor, drive assembly, and support structure.
- 2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
- 3. Factory-installed and -wired disconnect switch. C. Airfoil Wheels:
- 1. Single-width-single-inlet construction with smooth-curved inlet flange.
- 2. Heavy backplate.
- 3. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.
- 4. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
- D. Shafts:
 - 1. Statically and dynamically balanced and selected for continuous operation at maximumrated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
 - 2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
 - 3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- E. Grease-Lubricated Shaft Bearings (If belt drive):
 - 1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
 - 2. Ball-Bearing Rating Life: ABMA 9, LI0 at 120,000 hours.
 - 3. Roller-Bearing Rating Life: ABMA 11, LI0 at 120,000 hours.
- F. Belt Drives (If belt driven):
 - 1. Factory mounted, with adjustable alignment and belt tensioning.
 - 2. Service Factor Based on Fan Motor Size: 1.5
 - 3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
 - 4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
 - 5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
 - 6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamondmesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 - 7. Motor Mount: Adjustable for belt tensioning.

G. Accessories:

- 1. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
- 2. Spark-Resistant Construction: AMCA 99.
- 3. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

2.5 HIGH BLOW LAB EXHAUST FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Strobic Air.

B. General

- 1. Base fan performance at standard conditions (density 0.075 Lb. /ft³).
- 2. Each fan shall be direct driven in AMCA arrangement 2 according to drawings.
- 3. Each fan to be equipped with 316 stainless steel lifting lugs for corrosion resistance.
- 4. Fasteners exposed to corrosive exhaust shall be stainless steel.
- 5. Curb cap shall be hot rolled steel coated with corrosion resistant coating.
- 6. Fan assemblies that use flexible connectors that can fail and cause loss of laboratory containment shall not be acceptable.
- 7. Fan assembly shall be designed for project design wind loading, without the use of guy wires.
- 8. Fans to be constant plume design.
- C. Corrosion Resistant Coating
 - 1. All fan and system components (fan, nozzle, windband and plenum) shall be corrosion resistant coated with a two part electrostatically applied and baked, sustainable, corrosion resistant coating system, or equal. Standard finish color to be chosen by University.
 - 2. All parts shall be cleaned and chemically prepared for coating using a multi-stage wash system which includes acid pickling that removes oxide, increases surface area, and improves coating bond to the substrate.
 - 3. The first powder coat applied over the prepared surface shall be a zinc rich epoxy primer (no less than 70% zinc) and heated to a gelatinous consistency (partial cure) at which the second powder coat of polyester resin shall be electrostatically applied and simultaneously be cured at a uniform temperature of 400°F.
 - 4. The coating system, a total thickness of up to 6 mils, is not affected by the UV component of sunlight (does not chalk), and has superior corrosion resistance to acid, alkali, and solvents. Coating system shall exceed 4000 hour ASTM B117 Salt Spray Resistance.
 - 5. Note that 10-20 mil thick wet coating systems pollute the environment (air and water), and that these manually applied coatings are not uniform over the impeller surface and can cause fan imbalance and vibration.

D. Fan Housing and Outlet

- 1. Fan housing to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
- 2. Fan housing shall be bifurcated, allowing all drive components, including the motor, to be serviced without contact of the contaminated airstream. Must be manufactured of welded steel and meet specification section 2.5-C for corrosion resistant coating. No uncoated metal fan parts will be acceptable.
- 3. Fan housings that are fabricated of polypropylene or fiberglass that have lower mechanical properties than steel, have rough interior surfaces in which corrosive, hazardous compounds can collect, and / or which chalk and structurally degrade due to the UV component of the sunlight shall not be acceptable.
- 4. A multi-stage air induction discharge nozzle shall be supplied by the fan manufacturer designed to efficiently handle an outlet velocity of up to 7000 FPM. The multi-stage nozzle shall induce ambient air up to 270% of fan capacity. Nozzle / Wind band assemblies that are manufactured by third party vendors or that are fabricated of plastic or resins, having mechanical properties less than steel shall not be acceptable.
- 5. An integral fan housing drain shall be used to drain rainwater when the fan is deenergized.
- 6. A bolted & gasketed access door shall be supplied for impeller inspection and service.
- 7. Fan assembly shall be AMCA type C spark resistant construction minimum or as noted on the schedule.
- E. Fan Impeller
 - 1. Fan impeller shall be mixed flow design with non-stall characteristics. The impeller shall be electronically balanced both statically and dynamically exceeding AMCA Standards.
 - 2. Fan impeller shall be manufactured of welded and coated steel. Reference specification section 2.5-C for corrosion resistant coating.
 - 3. Fan impellers that are fabricated of polypropylene or fiberglass that have lower mechanical properties than steel, and lower maximum tip speeds are not acceptable.
 - 4. Vacuum Seal: Fan impeller shall include a secondary fan blade located on the impeller back plate. This secondary impeller shall create a negative pressure at the shaft opening; preventing hazardous or toxic exhaust fumes from escaping through the housing shaft opening. Mechanical shaft seals that wear out and need to be replaced or seal systems that use hoses or tubes that can leak, are not acceptable.
- F. Bypass Air Plenum
 - 1. For constant volume systems, the fan / nozzle assembly shall be connected directly to roof curb and exhaust duct without the need of the bypass air plenum. Fans mounted directly to roof curb shall be provided with a damper tray located in the roof curb for mounting of the gravity isolation damper.
 - 2. For variable volume systems, a bypass air plenum shall be provided as shown on drawings. The plenum shall be provided with bypass air damper(s) for introducing outside air at roof level upstream of the fan, complete with bypass air weatherhood and bird screen.
 - 3. The plenum shall be constructed of welded and coated steel and meet specification section 2.5-C for corrosion resistant coating. Plenums that are fabricated of plastics or resins that are combustible and have mechanical properties less than steel shall not be acceptable.

- 4. The bypass air plenum shall be mounted on factory fabricated roof curb provided by the fan manufacturer, as shown on the project drawings.
- 5. Fan designs that use inlet flexible connectors that can leak causing loss of lab exhaust shall not be permitted.
- 6. Bypass air damper(s) shall be opposed-blade design for airflow control, airfoil design, fabricated of galvanized steel for structural rigidity as standard. Bypass damper(s) shall have plated steel damper rods, stainless steel sleeved bearings, 301 stainless steel jamb seals and the blades shall have polymer edge seals. Damper model shall be equal to or exceed a heavy duty control damper, Greenheck HCD-130 or equal. Damper blade drive linkage shall be set by manufacturer and welded to eliminate linkage slippage. All damper access and service (drive actuators) shall be performed outside of the contaminated airstream.
- 7. If stated in the schedule notes, an optional, integral bypass air packed acoustic attenuator fabricated of galvanized steel shall be provided by the fan manufacturer (if shown on the drawings).
- 8. Fan isolation damper(s), shall be parallel-blade design, airfoil design, fabricated of steel for structural rigidity as standard. Damper(s) shall be coated up to 4 mils of chemically resistant Hi-Pro Polyester resin (or equal), electrostatically applied and baked. Isolation damper(s) shall have plated steel damper rods (if specified as 304 stainless steel damper, stainless steel damper rods will be provided), stainless steel sleeved bearings, 301 stainless steel jamb seals and the blades shall have polymer edge seals. Damper model shall be equal to or exceed a heavy duty control damper, Greenheck HCD-130 or equal. Damper blade drive linkage shall be set by manufacturer and welded to eliminate linkage slippage. All damper access and service (drive actuators) shall be performed outside of the contaminated airstream.
- 9. Isolation damper actuator(s), if scheduled shall be factory mounted and shall be wired to a step-down transformer. Actuator and transformer are located in a weatherproof enclosure.
- 10. Blower / Plenum vibration isolation shall be limited to neoprene / cork vibration pads.
- G. Bypass Air Plenum Curb
 - 1. Exhaust system manufacturer shall supply a structural support curb for the plenum of specified height as shown on the drawings.
 - 2. Curb shall be fabricated of a minimum of 12 gauge corrosion-resistant coated steel and structurally reinforced.
 - 3. Curb shall be insulated.
 - 4. When properly anchored to the roof structure, the standard curb / plenum / blower assembly shall withstand project required wind loadswithout additional structural support.
- H. Fan Motor and Drive
 - 1. Motors shall be premium efficiency, standard NEMA frame, 1800 or 3600 RPM, TEFC with a 1.15 service factor. A factory-mounted NEMA 3R disconnect switch shall be provided for each fan.
 - 2. Motor maintenance shall be accomplished without fan or fan impeller removal, or requiring maintenance personnel to access the contaminated exhaust components.
 - 3. Motor mounting shall be "C-face" and / or foot mount.

- 4. Drive arrangement shall be AMCA arrangement 2, utilizing a direct mount coupling connecting the motor shaft and fan impeller shaft. Belt drive arrangement 9 or 10, or direct drive arrangement 4 requiring access and handling of hazardous and contaminated fan components are not acceptable.
- 5. Fan shaft to be turned and polished of 1040 steel material as standard, coated with corrosion resistant coating.
- 6. Fan shaft bearing shall be Air Handling Quality, ball or roller pillow block type, and sized for an

L-10 life of no less than 200,000 hours.

- 7. All shaft bearings and non-permanently lubricated motors shall have nylon [stainless steel braided] extended lube lines with zerk fittings.
- 8. Motor, coupling, and bearing shall all be outside the contaminated exhaust, and be capable of replacement without disassembling fan and accessing hazardous and contaminated fan components.

2.6 FAN ARRAYS

- 1. Fan Array
 - a. Fan array system shall consist of multiple, direct driven, arrangement 4 plenum fans constructed per AMCA requirements for duty specified. Fans shall be selected to deliver scheduled airflow quantity at scheduled operating total static pressure and scheduled fan/motor speed. Fan array shall be selected to operate at system total static pressure that does not exceed 90% of scheduled fan's peak static pressure producing capability at scheduled fan/motor speed.
 - Fan intake wall, inlet funnel, and motor support structure shall be powder coated for superior corrosion resistance. Motors shall be standard pedestal mounted type, T-frame motors selected at specified operating voltage, rpm, and efficiency as needed to meet performance requirements. Motors shall include isolated bearings or shaft grounding. Each fan/motor cartridge shall be dynamically balanced to

meet AMCA standard 204-96, category BV-5, to meet or exceed Grade 2.5 residual unbalance.

- 1) Fan array shall provide uniform air flow and velocity profile across entire air way tunnel cross section. Airflow and velocity shall not exceed scheduled cooling coil and/or filter bank face velocity when measured at a point 12 inches from intake side of fan wall array intake plenum wall, and distance of 48 inches from discharge side of fan wall intake plenum wall.
- 2) Provide partition between fans to minimize system effect.
- 3) Provide structural frame to support upper fans with solid floor panel partition between fans as shown on drawings to minimize system effect.
- 4) Each fan in array shall be provided with back flow prevention means that produces less than 0.10 inches wc of static pressure drop and/or system effect when that fan is enabled. Any such system effects and/or pressure drops shall be submitted and included as component in determining fan system total static pressure as submitted. Manufacturer's pressure drop

ratings of any such equipment, developed from straight run test conditions will not be accepted.

- 5) Provide 2 separate variable frequency drives for fan array. Each VFD shall control half of fans in array. Provide one backup VFD for air handling unit.
- 6) Fan array shall be sized such that upon single fan failure, remaining fans could ramp up and provide same 100% design capacity.
- 7) Technology with multiple fans having individual VFDs may be considered.
- 8) Provide local electrical disconnect for each fan.
- 9) Contractor shall provide all wiring to air handling unit components that require power.

2.7 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 0513 "Motors."

2.8 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/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION AND ACCESS

- A. Install fans level and plumb and according to fan manufacturer's instructions..
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting: Install centrifugal fans on cast-in-place concrete equipment base(s) using elastomeric pads. Comply with requirements for equipment bases specified in Section 03 3000

"Cast-in-Place Concrete with requirements for vibration isolation devices specified in Section 23 0550 "Vibration Isolation."

- 1. Minimum Deflection: 1/4 inch (6 mm)
- 2. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
- 3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
- 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
- 5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
- 7. Install on 4-inch (100-mm) high concrete base.
- E. Equipment Mounting: Install centrifugal fans using elastomeric pads. Comply with requirements for vibration isolation devices specified in Section 23 0550 "Vibration Isolation."
 - 1. Minimum Deflection: 1/4 inch (6 mm).
- F. Equipment Mounting: Install centrifugal fans on vibration isolation equipment base. Comply with requirements specified in Section 23 0550 "Vibration Isolation"
- G. Equipment Mounting: Install continuous-thread hanger rods and [elastomeric hangers] [spring hangers] [spring hangers with vertical-limit stop] of size required to support weight of dehumidification unit.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 23 0550 "Vibration Isolation."
 - 2. Comply with requirements for hangers and supports specified in Section 23 0529 "Mechanical Supporting Devices."
- H. Curb Support: Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," Low-Slope Membrane Roofing Construction Details Section, Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction
- I. Unit Support: Install centrifugal fans level on structural curbs. Coordinate wall penetrations and flashing with wall construction.
- J. Isolation Curb Support: Install centrifugal fans on isolation curbs, and install flexible duct connectors and vibration isolation devices.
 - 1. Comply with requirements in Section 23 3314 "Ductwork Specialties" for flexible duct connectors.
 - 2. Comply with requirements in Section 23 0550 "Vibration Isolation" for vibration isolation devices.

- K. Install units with clearances for service and maintenance.
- L. Pipe housing drains to nearest point of proper discharge.
- M. Label fans according to requirements specified in Section 23 0553 "Mechanical System Identification."
- N. Provide/build OSHA approved engineered platforms for preventative maintenance for items not accessible from a normal area standing position.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 3314 "Ductwork Specialties."
- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: University will engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheelfree rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

- 9. See Section 23 0594 "Testing, Adjusting, and Balancing (TAB)" for testing, adjusting, and balancing procedures.
- 10. Remove and replace malfunctioning units and retest as specified above.
- D. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections. E. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train University maintenance personnel to adjust, operate, and maintain the equipment of this section.

END OF DOCUMENT 23 34 00

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. Pleated panel filters.
 - 2. Non-supported bag filters.
 - 3. Front- and rear-access filter frames.
 - 4. Electronic air cleaners.
 - 5. Side-service housings.
 - 6. Filter gages.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated

- B. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - 2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
 - 3. Include diagram for power, signal, and control wiring if applicable.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.
- B. Northwestern University Maintenance Requirement Forms, see Division 01.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Provide three complete set(s) of pre-filters for each pre-filter bank, one set for use during construction, one set for building turnover to University, and one spare set.
 - 2. Provide two complete set(s) of after and final filters for each after and final filter bank, one set for building turnover to University, and one spare set.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance:

- Comply with applicable requirements in ASHRAE 62.1, Section 4 "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
- 2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

B. Comply with NFPA 90A and NFPA 90B.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PLEATED PANEL FILTERS

- A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames, MERV 8, 2" thick.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
- B. Filter Unit Class: UL 900, Class 1 or Class 2.
- C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.
 - 1. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.
 - 2. Media shall be coated with an antimicrobial agent.

- 3. Separators shall be bonded to the media to maintain pleat configuration.
- 4. Welded-wire grid shall be on downstream side to maintain pleat.
- 5. Media shall be bonded to frame to prevent air bypass.
- 6. Support members on upstream and downstream sides to maintain pleat spacing.
- D. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.
- E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- F. See schedule on drawing for performance information.

2.3 NON-SUPPORTED BAG FILTERS

- A. Description: Factory-fabricated, dry, extended-surface, non-supported filters with header frames, MERV 13 or 14 as required for particular application on the project.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
- B. Filter Unit Class: UL 900, Class 1 or Class 2.
- C. Media: Synthetic material constructed so individual pockets are maintained in tapered form under rated-airflow conditions by flexible internal supports.
 - 1. Media shall be coated with an antimicrobial agent.
- D. Filter-Media Frame: Galvanized steel
- E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.
- F. See schedule on drawing for performance information.

2.4 FRONT AND REAR ACCESS FILTER FRAMES

A. Framing System: Galvanized-steel (minimum 16 gage) framing members with access for either upstream (front) or downstream (rear) filter servicing, cut to size and pre-punched for assembly into modules. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
- B. Pre-filters: Incorporate a separate track with spring clips, removable from front.
- C. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking cam or lever type devices, and arranged so filter cartridges can be loaded from either side and access door.
- D. Sealing: Factory-installed, positive-sealing device for each row of filters, to ensure seal between gasketed filter elements and to prevent bypass of unfiltered air.
- 2.5 ELECTRONIC AIR CLEANERS
 - A. Description: Factory-fabricated electronic air cleaner operating by electrostatic precipitation principles.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dynamic Air Quality Solutions.
 - b. Trion, Inc.
 - c. Flanders Corporation.
 - B. Collection Cells: Aluminum, independently supported and nested.
 - 1. Ionizing Section: Alternately spaced grounded struts and charged ionizing wires.
 - 2. Collecting Section: Alternately grounded and charged plates, with insulators located out of airstream.
 - C. Power Pack: Self-contained, prewired rectifying unit to convert 24-V ac, single-phase, 60-Hz power to approximately 9,500-V dc; include overload protection, on-off switch, pilot light showing operating status, and access door interlock.
 - D. Safety Accessories: Manual-reset safety switches and warning lights for filter plenum access doors, signal lights and safety switching upstream and downstream from unit within duct, and enameled high-voltage warning signs.
 - E. Controls: Programmable logic controller in remotely mounted NEMA 250, Type 12 enclosure; with integral time clock and manual override.
 - 1. Contacts for enable-disable control by building automation system.

F. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.6 SIDE-SERVICE HOUSINGS

- A. Description: Factory-assembled, side-service housings, constructed of [galvanized steel] with flanges to connect to duct or casing system.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AAF International.
 - b. Camfil Farr.
 - c. Flanders Corporation.
- B. Pre-filters: Integral tracks to accommodate project depth disposable filters.
- C. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking cam or lever type devices, and arranged so filter cartridges can be loaded from either side and access door.
- D. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.

2.7 FILTER GAGES

- A. Diaphragm-type gage with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dwyer Instruments, Inc.
 - 2. Diameter: 4-1/2 inches (115 mm).
 - 3. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg (125 Pa) or Less: 0- to 0.5-inch wg (0 to 125 Pa).
 - 4. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0Inch wg (125 to 250 Pa) or Less: 0- to 1.0-inch wg (0 to 250 Pa).
 - 5. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0Inch wg (250 to 500 Pa) or Less: 0- to 2.0-inch wg (0 to 500 Pa).
 - 6. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0Inch wg (500 to 750 Pa) or Less: 0- to 3.0-inch wg (0 to 750 Pa).
 - 7. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0Inch wg (750 to 1000 Pa) or Less: 0- to 4.0-inch wg (0 to 1000 Pa).
- B. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation devices specified in Section 23 0550 "Vibration Isolation."
- B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- C. Install filters in position to prevent passage of unfiltered air.
- D. Install filter gage for each filter bank.
- E. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- F. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.
- G. Coordinate filter installations with duct and air-handling-unit installations.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
 - 1. Test for leakage of unfiltered air while system is operating.
- D. Air filter will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.3 CLEANING

A. After completing system installation and testing, adjusting, and balancing of air-handling and air distribution systems, clean filter housings and install new filter media.

END OF DOCUMENTS 23 41 14

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Electrical submittals
 - 2. Electrical equipment coordination and installation.
 - 3. Electrical Owner furnished equipment requirements.
 - 4. Quality assurance requirements.
 - 5. Common electrical installation requirements.

1.2 SUBMITTALS

- A. Coordinate project submittal procedure and project close-out documents submittal procedure with Architect, Owner, and General Contractor.
- B. Product Data: For each type of product specified; at minimum:
 - 1. Gear: Switchgear, switchboard, panelboard, transformer, MCC, starter, disconnect.
 - 2. Lighting fixtures.
 - 3. Special Systems: Fire alarm, voice/data, and security.

1.3 COORDINATION

- A. Submit electrical coordination drawings for review for the following prior to: installation, floor and wall installation and final gear submittal:
 - 1. 1/4" scale plans for each electrical room locating and labeled for all equipment, panels, transformers, switches, disconnects, control panels, and their required clearances shown.
 - 2. 1/8" scale plans for all duct bank and feeder conduit routes showing all sizes, boxes and bends, and labels.
- B. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.

- 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- 5. To allow required maintenance access to pull and junction boxes above ceilings, in equipment rooms, and other congested spaces.
- C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

1.4 OWNER-FURNISHED EQUIPMENT

A. Coordinate electrical connections, grounding, isolating, and installation with vendors and Owner.

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.
- B. A licensed electrical foreman shall be on site at all times, and supervise installation of all work.
- C. Contractor shall comply with all applicable codes, AHJ requirements, Owner requirements, and federal regulations.

1.6 ELECTRICAL SERVICE INTERRUPTIONS

A. Hospitals are 365/24/7 occupancies with patients at risk. All service interruptions shall be fully planned and coordinated prior to work commencing. Owner's notification policy must be understood and obeyed by the Contractor and their vendors.

1.7 DEMOLITION

A. Demolish all indicated electrical gear, raceways, wiring, controls, electrical devices, and appurtenances from load to source. Demolition intent is the Contractor make all reasonable effort to remove all demolished electrical items in above ceiling spaces and exposed areas.

- B. Unless indicated otherwise, it is not intended the Contractor perform forensic demolition requiring significant field verification of circuits or controls that could be still active.
- C. Unless indicated otherwise, it is not intended the Contractor demolish concealed conduits in walls, floors, etc to remain, but to remove all cabling, cap conduit flush, and seal all openings from leakage.
- D. Except for conduit, wiring, and supports, the Owner has first refusal for items indicated for demolition. If the Owner refuses the item(s) then remove from Project site. Demolished conduit, wiring, and supports are the property of the Contractor. Remove all demolished items from the Project site and dispose of properly. Expenses associated with disposal are the Contractor's responsibility.

1.8 EXISTING CONDITIONS

- A. Modify the existing electrical system only where required.
- B. Clean, relamp, and repair existing light fixtures indicated for relocation.
- C. Visit the project site and become thoroughly familiar with existing conditions prior to offering a Bid.
- D. Report to the Architect unforeseen site conditions that may affect work at the time of discovery.
- E. Match fault current interrupting capacity, style, and manufacturer when adding circuit breakers to existing equipment.
- F. Submit overcurrent protection or motor control center starters which are being added to existing distribution equipment.
- G. Remove abandoned communications or signal circuits back to the source.

1.9 SELECTIVE COORDINATION

A. At minimum, all essential power supply system adjustable trip settings, elevator branch and feeder, and fire pump feeder, Over-Current protective devices within the scope of work shall selectively coordinate. Adjust settings in field to achieve coordination or replace equipment if miscoordinated. Refer to Specification Section 260573 "Over-Current Protective Device Coordination Study," for more details.

PART 2 - PRODUCTS

2.1 PLYWOOD BACKBOARDS

A. Use 5/8" thick, B-C rated, UL labeled, AWPA-C27 fire-resistant plywood.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items, to bottom of outlet box for wall-mounted items below 36", to top of outlet box for wall-mounted items above 36". Architectural documents take precedence when determining mounting heights. Coordinate location and height with Architectural elevations.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity. Provide manufacturer's recommended working clearance about all equipment, including ventilation clearances. Unless otherwise indicated or required by manufacturer, working clearance, working space, clearance, etc, shall be 36" minimum in front of all equipment.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 MOTORS

- A. Provide power wiring to motors and mechanical equipment through associated disconnect switches, and motor starters, including branch circuit power line controlling devices.
- B. Receive, store, and install individually mounted starters and controllers for motors.
- C. Connect equipment grounding conductor to motor grounding terminal.
- D. Connect multi-speed, reversible, and reduced voltage start motors as recommended by equipment manufacturer.

E. Coordinate motor overcurrent protection requirements with mechanical submittal prior to installation in panel.

3.3 ELECTRIC HEATERS

- A. Coordinate connection of electric heaters with requirements in other sections of the Specifications. Increment load sizes of electric heater elements shall be limited to that approved by the Electrical Code.
- 3.4 HEAT TAPE
 - A. Use 30 mA ground-fault protection when connecting heat tape.

3.5 HAZARDOUS LOCATIONS

A. In hazardous locations as classified by NEC, provide material and workmanship commensurate with the hazard.

3.6 LOW VOLTAGE CABLES

- A. Coordinate provisions of raceway and boxes for Low Voltage Cable installation.
- B. Provide Low Voltage Cabling for the following systems if included in scope of work. Refer to other specification sections whether they are Contractor furnished and installed, Owner furnished and Contractor installed, or Owner furnished and installed systems. Assume systems are run in conduit if not specified elsewhere. These include but are not limited to:
 - 1. Telemetry.
 - 2. Physio Monitoring.
 - 3. Voice or Telephone.
 - 4. Data, Computer, or Network.
 - 5. Security, CCTV, Access Controls.
 - 6. CATV and TV Antenna.
 - 7. Patient Archive (PACS).
- C. See specification sections for systems requiring low voltage cable. At a minimum use plenum rated, shielded cables or install in raceway.
- D. Provide raceway for Low Voltage Cables where run is in inaccessible locations. Provide insulated throat conduit bushing on conduit stub. Provide outlet boxes for Low Voltage Cables.
 - 1. Stub conduit into accessible ceiling space.

3.7 FAULT CURRENT PROTECTION

- A. Use a full-rated system to protect against fault currents. Each overcurrent device shall be capable of interrupting available fault current independent of other overcurrent devices. Do not use series rated devices.
- B. Ground Fault Provisions:
 - 1. GF protective device on service entrance main devices and next level downstream when main is 1000A frame or greater and voltage from phase to ground is above 150V.
 - 2. GF protective device on feeder device and next level downstream of normal power system devices 1000A frame or larger.

3.8 FUTURE DEVICES

- A. Provide fully prepared space for mounting of future devices when providing panelboards, switchboards, and switchgear outfitted with unused device spaces. Provide mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- B. Provide a minimum of one future device location when providing panelboards, switchboards, and switchgear.

3.9 SERVICE ENTRANCE

- A. Use SE rated device when circuit breaker or fused switch is used as service disconnect for service conductors or outdoor generator.
- B. All service entrance disconnects serving same building shall be located in same room or in separate rooms with a permanent plaque indicating the locations of all other services.
- C. Service entrance disconnects shall have a permanent warning label with calculated fault-current and date.
- D. Service entrance disconnects shall have a permanent warning label or diagram stating location of all other services or standby power sources serving same building.

3.10 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.11 METERING

A. Metering equipment will be provided for each electrical service and tenant. Coordinate metering with the utility company and provide metering components in accordance with the utility company's requirements.

3.12 BRANCH CIRCUITS

- A. Provide branch circuits as either two, three, or four wire circuits, run from the panels to outlets as indicated on the drawings. Provide each 120V or 277V circuit with a neutral conductor.
- B. Provide common tie-wrap on circuit breakers comprising multi-circuit branch circuit home runs, or provide dedicated neutrals. Provide dedicated neutrals for all multi-circuit branch circuit homeruns serving patient care areas.

3.13 SERVICE CONDUCTORS

A. To service disconnecting means, route service entrance conductors outside of building or encase raceway and conductors in a 2-hour protection of concrete.

3.14 FIELD QUALITY CONTROL

- A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.
- B. At the time of final review of electrical work, demonstrate the operation of electrical systems. Furnish labor, apparatus, and equipment for systems' demonstration.
- C. After demonstration of systems, turn over to Owner: one set of final electrical shop drawings, instruction and maintenance manuals, and keys for electrical equipment locks.

END OF SECTION 26 05 00

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

- 1. Section 260513 "Medium-Voltage Cables" for single-conductor and multi-conductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
- 2. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.
- 3. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THW-2 Type THHN/THWN-2 Type XHHW-2.
- C. Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 8 AWG and larger.
- C. CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
- D. Service Entrance: Type THHN/THWN-2, single conductors in raceway Type XHHW-2, single conductors in raceway.
- E. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway Type XHHW-2, single conductors in raceway.
- F. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway Armored cable, Type AC Metal-clad cable, Type MC.
- G. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway Type XHHW-2, single conductors in raceway,
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway Armored cable, Type AC Metal-clad cable, Type MC.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway Type XHHW-2, single conductors in raceway

- J. Branch Circuits Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway Armored cable, Type AC Metal-clad cable, Type MC
- K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, and strain relief device at terminations to suit application.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.4 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
DOCUMENT 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

- B. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19

DOCUMENT 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

- A. Insulated Conductors: tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

DOCUMENT 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

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B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

DOCUMENT 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

DOCUMENT 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 26 05 26

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Requirements:
 - 1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings. For fabrication and installation details for electrical hangers and support systems.
- C. Delegated-Design Submittal: For hangers and supports for electrical systems.
 - 1. Include design calculations and details of trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, and coordinated with each other, using input from installers of the items involved:
- B. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
- C. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 1. Material: Pre-galvanized steel Plain steel
 - 2. Channel Width: 1-5/8 inches (41.25 mm)
 - 3. Retain one or more of "Metallic Coatings," "Nonmetallic Coatings," and "Painted Coatings" subparagraphs below. Coordinate with the appropriate coating or painting Specification Section.
 - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 - 8. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel for use in hardened portland cement concrete, with tension, shear, and pullout capacitie s appropriate for supported loads and building materials where used.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: [All-steel] [Stainless-steel] springhead type.

7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2inch (38-mm) 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. 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 (90 kg).
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.
 - 7. Handholes and boxes for exterior underground cabling.
- B. Related Requirements:
 - 1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
 - 2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
 - 3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.2 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products 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. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PRODUCTS

1.4 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit IMC.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel or die cast.
 - b. Type: Setscrew

- 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

1.5 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 Type 3R unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

1.6 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- 1.7 SURFACE RACEWAYS
 - A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.
 - C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

1.8 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Metal Floor Boxes:
 - 1. Material: Cast metal or sheet metal].
 - 2. Type: Fully adjustable Semi-adjustable.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Nonmetallic Floor Boxes: Nonadjustable, round rectangular.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

- H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).
 - 1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, [cast aluminum] [galvanized, cast iron] with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- M. Gangable boxes [are allowed] [are prohibited].
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, [Type 1] [Type 3R] [Type 4] [Type 12] <Insert type> with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: [Plastic] [Fiberglass].
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- O. Cabinets:
 - 1. NEMA 250, [Type 1] [Type 3R] [Type 12] <Insert type> galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1. Standard: Comply with SCTE 77.
 - 2. Configuration: Designed for flush burial with [open] [closed] [integral closed] bottom unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, "ELECTRIC."
 - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of [polymer concrete] [reinforced concrete] [cast iron] [hot-dip galvanized-steel diamond plate] [fiberglass].
 - 1. Standard: Comply with SCTE 77.
 - 2. Configuration: Designed for flush burial with [open] [closed] [integral closed] bottom unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, ["ELECTRIC."] <Insert legend>.
 - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

EXECUTION

1.10 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC, IMC.
 - 2. Concealed Conduit, Aboveground: EMT.
 - 3. Underground Conduit: Type EPC-40-PVC concrete encased(service).
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
 - 1. Exposed, Not Subject to Physical Damage: EMT or RNC.

RACEWAY AND BOXES FOR ELECTRICAL SYSYTEMS

- 2. Exposed, Not Subject to Severe Physical Damage: EMT, RNC identified for such use].
- 3. Exposed and Subject to Severe Physical Damage: GRC, IMC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
 - e. <Insert designations of applicable spaces or locations>.
- 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
- 6. Damp or Wet Locations: IMC.
- 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel, nonmetallic in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use setscrew fittings. Comply with NEMA FB 2.10.
 - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.

1.11 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hotwater pipes. Install horizontal raceway runs above water and steam piping.

- C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches (300 mm)of enclosures to which attached.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to RNC, GRC or IMC before rising above floor.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

- N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- O. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm)radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- R. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C)
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) <Insert temperature> temperature change.
 - c. Attics: 135 deg F (75 deg C)
 - d. <Insert location and corresponding temperature change>.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

- 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for [recessed and semirecessed luminaires,]equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to [center] [top] [bottom] of box unless otherwise indicated.
- U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
- V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- W. Locate boxes so that cover or plate will not span different building finishes.
- X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Z. Set metal floor boxes level and flush with finished floor surface.
- AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

1.12 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
 - 2. Install backfill as specified in Section 312000 "Earth Moving."
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as

temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

- 4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
- 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
- 6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

1.13 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line, <Insert depth of frost line below grade at Project site> below grade.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

1.14 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 1.15 FIRESTOPPING
 - A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

1.16 **PROTECTION**

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.
- B. Related Requirements:
 - 1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fireresistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

- 2.1 SLEEVES
 - A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

- 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Sealing Elements: **EPDM Nitrile Bun** rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: **Carbon steel**, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.
- 2.5 SILICONE SEALANTS
 - A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall have VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

- 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed
- 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
- 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches 50 mm above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boottype flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using **steel cast-iron** pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels, including arc-flash warning labels.
 - 8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For arc-flash hazard study.

PRODUCTS

1.3 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- 1. Black letters on an orange field
- 2. Legend: Indicate voltage and system or service type.
- B. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER ELECTRICAL SHOCK HAZARD EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING OSHA REGULATION AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

1.5 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Self-Adhesive Labels:
 - 1. Write-on, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.
 - 2. Polyester, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
 - a. Nominal Size: 3.5-by-5-inch (76-by-127-mm).

1.6 TAPES AND STENCILS:

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
- C. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
 - 1. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE"

- 2. Tag: Type I
 - a. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 - b. Width: 3 inches (75 mm).
 - c. Thickness: 4 mils (0.1 mm). Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
 - d. Tensile according to ASTM D 882: 30 lbf (133.4 N) and 2500 psi (17.2 MPa).
- 3. Tag: Type ID
 - a. 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.
 - b. Width: 3 inches (75-mm).
 - c. Overall Thickness: 5 mils (0.125 mm).
 - d. Foil Core Thickness: 0.35 mil (0.00889 mm).
 - e. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
 - f. Tensile according to ASTM D 882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).
- 4. Tag: Type IID
 - a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, 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.
 - b. Width: 3 inches (75-mm)
 - c. Overall Thickness: 8 mils (0.2 mm).
 - d. Foil Core Thickness: 0.35 mil (0.00889 mm).
 - e. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
 - f. Tensile according to ASTM D 882: 300 lbf (1334 N) and 12,500 psi (86.1 MPa).

1.7 Tags

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, **0.023 inch (0.58 mm)** thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
- C. Write-On Tags:
 - 1. Polyester Tags: **0.015 inch (0.38 mm)** thick, with corrosion-resistant grommet and cable tie for attachment to raceway, conductor, or cable.

- 2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
- 3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

1.8 Signs

- A. Baked-Enamel Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 - 3. Nominal Size: 7 by 10 inches (180 by 250 mm).
- B. Metal-Backed Butyrate Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396inch (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).
- C. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to 20 sq. inches (129 sq. cm), minimum 1/16-inch- (1.6-mm-).
 - b. For signs larger than 20 sq. inches (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Engraved legend with black letters on white face.
 - d. Self-adhesive.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

1.9 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black, except where used for color-coding.

- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 - 5. Color: Black.

1.10 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.

EXECUTION

1.11 INSTALLATION

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- D. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- E. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.

1.12 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive vinyl label Install labels at **30-foot (10-m)** maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use industry standard colors for ungrounded branch-circuit conductors.
 - a. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
 - 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless

otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Bakedenamel 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.
- I. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
 - 1. Comply with NFPA 70E and ANSI Z535.4.
 - 2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine plastic 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 labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 26 05 53

DOCUMENT 26 09 26– LIGHTING CONTROLS PANELBOARDS

GENERAL

1.1 SUMMARY

A. Section Includes: Lighting controls using electrically operated circuit breakers.

1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- B. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- C. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each lighting control panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail bus configuration, current, and voltage ratings.
 - 3. Short-circuit current rating of panelboards and overcurrent protective devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For panelboards, accessories, and components, from manufacturer.
- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

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- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Printout of software application and graphic screens.
 - 4. Device address list.
- 1.6 QUALITY ASSURANCE
 - A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **Five** years from date of Substantial Completion.

PRODUCTS

1.8 MANUFACTURERS

A. <u>Siemens</u>, Eaton, Schneider or UL approved equivalent.

1.9 SYSTEM DESCRIPTION

- A. Input signal from field-mounted or on-board signal source shall open or close one or more electrically operated circuit breakers in the lighting control panelboards. Any combination of inputs shall be programmable to any combination outputs.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with 47 CFR, Subpart A and Subpart B, for Class A digital devices.

1.10 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

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- 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event**."
- 2. Component Importance Factor: **1.5**.

1.11 PANELBOARDS

- A. The lighting panelboards may contain remotely operated circuit breakers and standard branch circuit breakers specified in Section 262416 "Panelboards."
- B. Assemblies: Comply with UL 67 and NEMA PB 1.
- C. Surge Protective Device: Field mounted, complying with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."
- D. Surge Protective Device: Integrally mounted, complying with UL 1449 Type 1.
 - 1. Comply with IEEE C62.41, Category C, 200-kA short-circuit current rating.
 - 2. Non-modular type with the following features and accessories:
 - a. Digital-display indicator lights for power and protection status.
- E. Enclosures: Comply with UL 50 and NEMA 250.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt 22-kA symmetrical short-circuit current available at terminals.

1.12 CIRCUIT BREAKERS

- A. Remotely operated branch circuit breakers used for lighting control shall provide branch-circuit overcurrent protection.
- B. Labeled with SWD and HID Ratings: Comply with UL 489 for 15- and 20-A, single-pole branch devices. 15- and 20-A circuit breakers, if scheduled, shall be a product of same manufacturer and be of same class as the rated circuit breakers.
- C. Switching Endurance Rating: Not less than **200,000** full-load open/close/open remote operations.

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D. Remotely Operated Circuit Breakers: Manual override switch or handle position shall enable or disable the remote operation of the device and allow breaker handle to manually control the breaker's on-off status.

1.13 CONTROLLERS

- A. Description: Controllers shall contain the power supply and electronic control for operating and monitoring remotely operated branch circuit breakers.
 - 1. Comply with UL 916; with a microprocessor-based, solid-state, 365-day timing and control unit.
 - 2. Power Supply: Powered from the panelboard, sized to provide control power for the operation of the remotely operated circuit breakers, controller, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.
 - 3. Integral keypad and digital-display front panel for local setup, including the following:
 - a. Blink notice, time adjustable from software.
 - b. Ability to log and display remotely operated breaker on-time.
 - c. Capability for accepting downloadable firmware so that the latest production features may be added in the future without replacing the module.
 - 4. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation.
 - 5. Time Synchronization: The timing unit shall be updated not less than every 24 hour(s) with the network time server.
- B. Timing Unit:
 - 1. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
 - 2. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
 - 3. **16** independent schedules, each having **24** time periods.
 - 4. Schedule periods settable to the minute.
 - 5. Day of week, day of month, day of year with one-time or repeating capability.
 - 6. **32** special date periods.
- C. With 16 > inputs, each configurable to the following parameters:
 - 1. Normally open, normally closed, two-wire maintained toggle, two-wire momentary toggle, two-wire momentary on, two-wire momentary off, or three-wire momentary operation.
 - 2. On and off-delay timers for local override operation, adjustable from five minutes to 12 hours. Local override shall be by field-installed, two-wire momentary toggle switch.

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1.14 MANUAL SWITCHES AND PLATES

- A. Keypads: Programmable, designed to control lighting applications and functions associated with the equipment of this Section. The units shall be able to control any system output device, including remotely operated circuit breakers, relays, dimmers, and analog outputs.
- B. Push-Button Switches: Modular, momentary-contact, low-voltage type.
 - 1. Match color specified in Section 262726 "Wiring Devices."
 - 2. Integral green **LED** pilot light to indicate when circuit is on.
 - 3. Internal white **LED** locator light to illuminate when circuit is off.
- C. Manual, Maintained Contact, Full- or Low-Voltage Switch: Comply with Section 262726 "Wiring Devices."
- D. Wall Plates: Single and multigang plates as specified in Section 262726 "Wiring Devices."
- E. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

1.15 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Class 2 and Class 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

EXECUTION

- 1.16 WIRING INSTALLATION
 - A. Comply with NECA 1.
 - B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters **and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used**. Conceal raceway and cables except in unfinished spaces.

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- 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- 2. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."
- 3. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

1.17 PANELBOARD INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to **NEMA PB 1.1**.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Mounting Height: 90 inches (2286 mm) to top of trim above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install filler plates in unused spaces.

1.18 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- C. Create a directory to indicate loads served by each circuit; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are unacceptable.
- D. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

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1.19 FIELD QUALITY CONTROL

A. Testing Agency: **Owner will engage** a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

- 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Panelboard will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

1.20 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control modules.

END OF SECTION 26 09 26

LIGHTING CONTROLS PANELBOARDS

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.
- B. SPD: Surge protective device.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Include evidence of NRTL listing for SPD as installed in panelboard.
 - 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 8. Include wiring diagrams for power, signal, and control wiring.
 - 9. Key interlock scheme drawing and sequence of operations.
 - 10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 FIELD CONDITIONS

- A. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PRODUCTS

1.8 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Flush and Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1
 - 2. Height: 84 inches (2.13 m) maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.

- 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
- F. Incoming Mains Location: Top Bottom Convertible between top and bottom.
- G. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Tin-plated aluminum Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
 - 3. Ground Lugs and Bus-Configured Terminators: Compression type, with a lug on the bar for each pole in the panelboard.
 - 4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- J. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- K. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1.9 PERFORMANCE REQUIREMENTS

1.10 POWER PANELBOARDS

- A. Panelboards: NEMA PB 1, distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than [6 inches (914 mm) high, provide two latches, keyed alike.

PANELBOARDS

C. Mains: Circuit breaker Fused switch Lugs only.

- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolton circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices: Fused switches.

1.11 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker or lugs only.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- E. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.

1.12 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A.
- B. MCCB: Comply with UL 489, with series-connected rating interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with frontmounted, field-adjustable trip setting.
 - 3. Electronic Trip Circuit Breakers:
 - a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.
 - c. Digital display of settings, trip targets, and indicated metering displays.

- d. Multi-button keypad to access programmable functions and monitored data.
- e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
- f. Integral test jack for connection to portable test set or laptop computer.
- g. Field-Adjustable Settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long and short time adjustments.
 - 4) Ground-fault pickup level, time delay, and I squared T response.
- 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
- 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
- 6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
- 7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
- 8. Subfeed Circuit Breakers: Vertically mounted.
- 9. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.
 - g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
 - 1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

1.13 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

1.14 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

EXECUTION

1.15 INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NEMA PB 1.1.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box.
- F. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- H. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- I. Install filler plates in unused spaces.
- J. Stub four 1-inch (27-EMT) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-EMT) empty conduits into raised floor space or below slab not on grade.
- K. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

PANELBOARDS

1.16 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

1.17 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 24 16

PANELBOARDS

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Weather-resistant receptacles.
 - 3. Snap switches and wall-box dimmers.
 - 4. Solid-state fan speed controls.
 - 5. Wall-switch and exterior occupancy sensors.
 - 6. Communications outlets.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- 1.5 CLOSEOUT SUBMITTALS
 - A. Operation and maintenance data.

PRODUCTS

1.6 MANUFACTURERS

A. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

1.7 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

1.8 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1.9 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, **feed**-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1.10 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:

WIRING DEVICES

- 1. Single Pole:
- 2. Two Pole:
- 3. Three Way:
- 4. Four Way:
- C. Key-Operated Switches, 120/277 V, 20 A:
 - 1.
 - 2. Description: Single pole, with factory-supplied key in lieu of switch handle.

1.11 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1.

B. GFCI, Feed Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

1.

1.12 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
- B. Wall Plate Color: For plastic covers, match device color.

EXECUTION

- 1.13 INSTALLATION
 - A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
 - B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

WIRING DEVICES

- 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
- 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
- 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold devicemounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

- 1. Install dimmers within terms of their listing.
- 2. Verify that dimmers used for fan speed control are listed for that application.
- 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

1.14 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

1.15 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 >.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event**."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- 1.7 QUALITY ASSURANCE
 - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. <u>Siemens, Schneider, Eaton</u>
- B. Type HD, Heavy Duty, Single Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate **specified** fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Lugs: Suitable for number, size, and conductor material.
 - 5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Siemens, Schneider, Eaton

- B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Single Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Six Pole, Single Throw, **600**-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Double Throw, [240] [600]-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Lugs: Suitable for number, size, and conductor material.

2.3 RECEPTACLE SWITCHES

- A. <u>Leviton, Pass-Seymour</u>
- B. Type HD, Heavy-Duty, Single-Throw Fusible Switch: **240** or **600**-V ac, **30 60 100** A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate **specified** fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: **240** or **600**-V ac, **30 60 100** A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- E. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).
 - 1. Receptacle Manufacturer and Catalog Number:

2.4 MOLDED-CASE CIRCUIT BREAKERS

- A. Siemens, Schneider, Eaton
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I²t response.
- E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- F. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Ground-Fault Protection: Comply with UL 1053; **integrally mounted, self-powered** type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 6. Auxiliary Contacts: **One SPDT switch** with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 7. Alarm Switch: One [NO] [NC] contact that operates only when circuit breaker has tripped.

2.5 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, **Type 1**
 - 2. Outdoor Locations: NEMA 250, **Type 3R**

ENCLOSED SWITCHES AND CIRCUIT BREAKER

3. Other Wet or Damp, Indoor Locations: NEMA 250, **Type 4** Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

- 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior solid-state luminaires that use LED technology.
 - 2. Lighting fixture supports.

B. Related Requirements:

- 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
- 2. Section 260926 "Lighting Control Panelboards" for panelboards used for lighting control.
- 3. Section 260933 "Central Dimming Controls" or Section 260936.19 "Standalone Multipreset Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming ballasts specified in interior lighting Sections.
- 4. Section 260943.16 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, arranged by designation.

LED INTERIOR LIGHTING

- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4.2: For paints and coatings, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Product Schedule: For luminaires and lamps.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:
- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of luminaire.
- D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. CRI of 80. CCT of 3000 K.
- F. Rated lamp life of 50,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: 120 V ac.
 - 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- J. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. Clear finish.

2.3 DOWNLIGHT

- A. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.
- B. Universal mounting bracket.
- C. Integral junction box with conduit fittings.

2.4 LOWBAY

- A. Minimum 5,000lumens. Minimum allowable efficacy of 80 lumens per watt.
- B. Universal mounting bracket.

2.5 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging
- B. 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. Tempered Fresnel glass Retain "Acrylic" Subparagraph below if acrylic options in "Diffusers and Globes" Paragraph above are retained.
 - 2. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 3. Glass: Annealed crystal glass unless otherwise indicated.
 - 4. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded-aluminum housing and heat sink.
 - 2. Clear finish.

2.6 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, [12 gage (2.68 mm)]
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports: Sized and rated for luminaire weight.
- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls
 - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.

LED INTERIOR LIGHTING

- 2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
- I. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 51 19

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
 - 2. Luminaire supports.
 - 3. Luminaire-mounted photoelectric relays.

B. Related Requirements:

- 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
- 2. Section 260926 "Lighting Control Panelboards" for panelboard-based lighting control.
- 3. Section 260943.16 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
- 4. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

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. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
- B. Shop Drawings: For nonstandard or custom luminaires.

LED EXTERIOR LIGHTING

- 1. Include plans, elevations, sections, and mounting and attachment details.
- 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- 3. Include diagrams for power, signal, and control wiring.
- C. LEED Submittals:
 - 1. Product Data for Credit EA 5: For specified metering equipment.
 - 2. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale and coordinated.
- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of the following:
 - 1. Luminaire.
 - 2. Photoelectric relay.
- D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.6 FIELD CONDITIONS

A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.7 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

LED EXTERIOR LIGHTING

1. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. Lamp base complying with ANSI C81.61.
- F. CRI of minimum 80 CCT of 3000 K.
- G. L70 lamp life of 50,000 hours.
- H. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- I. Nominal Operating Voltage: 120 V ac.
- J. In-line Fusing: On the primary for each luminaire.
- K. Lamp Rating: Lamp marked for outdoor use
- L. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- M. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

LED EXTERIOR LIGHTING

- B. Sheet Metal Components: corrosion-resistant aluminum Form and support to prevent warping and sagging.
- C. 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.
- D. Diffusers and Globes:
 - 1. Acrylic Diffusers: 100 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.
- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- G. Housings:
 - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
 - 2. Provide filter/breather for enclosed luminaires.

2.4 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. 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.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
- 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
- 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
 - a. Color:Dark bronze
- D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Architect's sample of manufacturer's standard color.
 - c. Color: As selected by Architect from manufacturer's full range.

2.5 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

3.2 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

- A. Aim as indicated on Drawings.
- B. Install on concrete base with top **4 inches (100 mm)** 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 Section 033000 "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 Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative]
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

- 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
 - a. IES LM-5.
 - b. IES LM-50.
 - c. IES LM-52.
 - d. IES LM-64.
 - e. IES LM-72.
 - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

END OF SECTION 26 56 19
PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Site Investigation
- B. Protection
- C. Dust Control
- D. Site Clearing
- E. Removal of Existing Structures and Materials
- F. Topsoil Stripping
- G. Burning of Material on the Work Site
- H. Material Storage and Disposal

1.2 RELATED SECTIONS

- A. Section 31 20 00 Earth Moving
- B. Section 02 32 00 Geotechnical Subsurface Investigation Report

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for disposal of debris and burning of debris on site.
- B. Coordinate clearing Work with affected utility companies.

PART 2- PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 SITE INVESTIGATION

- A. The Contractor shall verify that existing plant life designated to remain is tagged or identified.
- B. The Contractor shall identify an area for placing removed material and inform the Engineer for his approval.

SITE CLEARING

3.2 PROTECTION

- A. The Contractor shall identify the locations of all utilities in the project area.
- B. Where utilities are to be crossed, they shall be uncovered by hand excavation methods before other excavation near them is started. The Contractor shall coordinate all utility locations with the utility owner. Every pipe for water, gas, drainage, or other use, and every conduit, foundation, or other underground structure encountered shall be carefully protected from damage or displacement.
- C. The Contractor shall not remove vegetation which has been marked or identified to be saved by the Engineer. If any vegetation so marked appears to be in conflict with areas to be cleared, the Contractor shall inform the Engineer for his decision.
- D. The Contractor shall protect bench marks and survey control points around the project area.
- E. When directed by the Engineer, the Contractor shall provide fences to protect trees to remain at the Work area.
- F. The Contractor shall be responsible for the prevention and control of soil erosion and gullying as a result of the construction. The Contractor shall prevent excessive erosion within the project area and property immediately adjacent thereto. Ground where the soil has been exposed shall be revegetated with grass. Slopes in channel relocations shall be seeded and fertilized above the water line. Fill slopes shall be provided with adequate slope protection as detailed on the Plans or as directed by the Engineer. All soil left within the right-of-way shall be leveled off, dressed out and seeded in a manner that will permit the ground surface to return to a natural state.
- G. Construction operations shall be planned and conducted in such a manner to prevent adverse impact on streams, lakes, and reservoirs with sediment or other harmful material used in the construction of the project. The Contractor shall comply with all regulations of the Environmental Protection Agency and the Alabama Department of Environmental Management.
- H. The discharge ends of all channel relocations shall be aligned to provide direct flow into existing stream beds without an abrupt direction change.

3.3 DUST CONTROL

- A. The Contractor shall control objectionable dust caused by operation of vehicles and equipment in the work area. The Contractor shall apply water or use other methods, subject to approval of the Engineer, to control the amount of dust generated by construction operations.
- B. Work areas inside the project site shall be broom cleaned and debris removed at the end of each working day. Damp mopping will be performed if required to collect dust. Floors and equipment shall be protected from foot traffic as required with walkway protection.
- C. The Contractor shall reference the "Field Guide for Erosion and Sediment Control on Construction Sites in Alabama" for more details.

3.4 SITE CLEARING

- A. Prior to starting construction operations, the Contractor shall remove all weeds, vegetable growth, bushes, stumps, debris, and other objectionable matter standing or lying on the surface within the limits of the areas to be excavated or filled; and shall demolish and remove them from such buildings and other structures as are specifically designated on the Plans for removal.
- B. Clearing shall be performed to provide access and to ensure the safety of employees working at the project area.
- C. The Contractor shall remove trees and plants in a manner to prevent injury to remaining trees, plants, and structures which are to be preserved. All stumps shall be completely removed and disposed of in accordance with the requirements of this section.
- D. The Contractor shall remove undergrowth and deadwood without disturbing subsoil. The Contractor will not be allowed to bury any vegetation or debris.
- E. The Contractor shall saw cut along neat lines for removal of paving, curbs, and gutters as required to perform the Work.

3.5 REMOVAL OF EXISTING STRUCTURES AND MATERIALS

- A. All existing structures encountered within the established lines, grades, or trenching sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the Work, or to remain in place.
- B. Should the Contractor encounter an existing structure (above or below ground) in the work area for which the disposition is not indicated on the Plans, the Engineer shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the Engineer in accordance with the provisions of the Contract.
- C. It is intended that all existing materials or structures that may be encountered (within the lines, grades, or trenching sections established for completion of the Work), be utilized in the Work if they are suitable and acceptable to the Engineer. Such existing materials or structures which are not suitable or acceptable for use in the Work shall be disposed of as specified in this section.

3.6 TOPSOIL STRIPPING

- A. The Contractor shall remove topsoil from areas to be further excavated or graded.
- B. Excavated soil shall be stockpiled at an area approved by the Engineer to a depth not exceeding eight (8) feet. Stockpiled soil shall be protected from erosion.
- C. The Contractor shall not excavate wet soil.
- D. The Contractor shall reference the "Field Guide for Erosion and Sediment Control on Construction Sites in Alabama" for more details.

3.7 MATERIAL STORAGE AND DISPOSAL

- A. The Contractor shall stockpile excavated material to the satisfaction of the Engineer until required for backfill or fill. The Contractor shall place, grade, and shape stockpiles for proper drainage.
- B. All materials removed during site preparation and by excavation which are suitable for the purpose shall be used whenever practical for backfilling and for such other purposes as may be shown on the Plans or directed by the Engineer. All materials not used for such purposes shall be considered as waste materials and disposed of by the Contractor in an approved manner.
- C. Waste materials may be deposited in spoil banks at locations to be obtained by the Contractor. Such materials shall not be left in unsightly piles, but shall be spread in uniform layers and neatly leveled and shaped to the satisfaction of the property owner.
- D. Spoil banks shall be provided with adequate openings to permit surface drainage of adjacent lands.
- E. The toe of fill slopes will not be allowed to fall within stream or creek channels unless so noted on the Plans or directed by the Engineer.
- F. The Contractor shall locate and retain soil materials away from the edge of excavations. The Contractor shall not store soil materials within drip line of trees indicated to remain.
- G. Fuels, oils, bitumen, or other greasy or chemical substances originating from construction operations shall not be allowed to enter or be placed where it may contaminate soil, groundwater, or surface water.
- H. On completion of any part of the Work, proper disposal shall be made of all surplus or unused materials left within the construction limits of such work and the surface of the Work left in a neat and workmanlike condition.
- I. Where materials are to be disposed of on private property, the Contractor shall furnish to the Engineer a copy of a written release signed and approved by the private property owner, allowing the Contractor to dispose of the waste material on that private property, prior to beginning disposal operation.
- J. All waste material resulting from site preparation and excavation activities shall be disposed of in accordance with regulations established by the United States Environmental Protection Agency (EPA), the Alabama Department of Environmental Management (ADEM), and in a manner approved by the Engineer.
- K. Spoil areas shall be seeded in accordance with Section 02930 Site Restoration.

END OF DOCUMENT 31 10 00

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General
- B. Excavation for Structures and Utilities
- C. General Backfill
- D. Backfilling of Trenches
- E. Backfilling of Structures
- F. Tolerances
- G. Cleanup

1.2 RELATED SECTIONS

- A. Section 31 10 00 Site Clearing
- B. Section 03 30 53 Cast In Place Concrete for Site Work
- F. Section 32 91 13 Site Restoration

1.3 REFERENCES

- A. Geotechnical Sub Surface Investigation Report on the Property.
- B. ASTM C-33 Concrete Aggregates.
- C. ASTM C-136 Method for Sieve Analysis of Fine and Coarse Aggregates.
- D. ASTM D-698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.49 kg.) Rammer and 12 inch (305 mm) Drop.
- E. ASTM D-1556 Test Method for Density of Soil in Place by the Sand-Cone Method.
- F. ASTM D-1557 Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 kg.) Rammer and 18 inch (457 mm) Drop.
- G. ASTM D-2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

- H. ASTM D-3017 Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- I. ASTM D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- 1.4 QUALITY ASSURANCE
 - A. An independent testing services company selected and paid by the Owner, will be retained to perform testing on filling operations and subgrade analysis. If tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace, and retest at no cost to the Owner.

1.5 SUBMITTALS

- A. The Contractor shall submit unit prices for additional earth excavation, rock excavation, and filling, should the base amount under these items be exceeded.
- B. The Contractor shall submit backfill material sources and product quality information.
- C. The Contractor shall record location of utilities, as installed, referenced to survey benchmarks. The Contractor shall include location of utilities encountered or rerouted. The Contractor shall give horizontal dimensions, elevations, inverts, and gradients.

1.4 DEFINITIONS

Rock includes:

- A. Material which cannot be excavated by equipment which is used to remove earth overburden without the use of explosives, rock rippers, rock hammers, or jack hammers.
- B. Material that cannot be removed with a backhoe, trenching machines, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the used of explosives, rock rippers, rock hammers, or jack hammers.

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. The Contractor shall perform excavation with equipment suitable for achieving the required test results as given on the sub surface investigation report for the property.
- B. The Contractor shall use equipment which will produce the degree of compaction specified.

2.2 EARTH BACKFILL

A. Existing unsuitable material for filling shall be removed and replaced with proper material as recommended on the sub surface investigation report.

2.3 BACKFILL OF TRENCHES

- A. Pipe Bedding is defined as the material placed between the trench bottom or foundation backfill and the bottom of the pipe.
- B. Pipe initial backfill is defined as material placed from the top of pipe bedding to one (1) foot above the top of the pipe.
- C. Pipe initial backfill shall be special stone aggregate backfill meeting the requirements of this sec tion or as specified by the utility company.
- D. Pipe trenches cut in natural soil:
 - 1. General backfill for pipe trenches cut in natural soil shall be earth backfill placed in pipe trench from the top of the initial backfill to finished grade.
- E. Pipe trenches cut in pavement:
 - 1. General backfill for pipe trenches cut in pavement shall be special stone aggregate backfill placed in pipe trench from the top of the initial backfill to sub-base of the pavement.

2.4 SPECIAL STONE AGGREGATE BACKFILL

A. Special stone aggregate backfill shall be crushed limestone, dolomite aggregate, or other suitable material. The gradation shall be in accordance with ASTM C-136.

PART 3-EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The Contractor shall conduct construction work including excavation and backfilling complying with Geotechnical Sub Surface Investigation Report Recommendations.
- B. The Contractor shall verify that areas to be backfilled are free of debris, snow, ice, or water and surfaces are not frozen. The Contractor shall not backfill over porous, wet, frozen, or soft subgrade surfaces.
- C. The Contractor shall stake, mark, or identify required lines, levels, slopes, grading, and datum.
- D. The Contractor shall compact subgrade to density as required for subsequent backfill materials.
- E. The Contractor shall cut out soft areas of subgrade not capable of insitu compaction and backfill with fill or foundation backfill as directed by the Engineer, and compact to density equal to or greater than the requirements for subsequent backfill material at the direction of the Engineer.

- F. The Contractor shall protect plant life, lawn, rock outcropping, and other features remaining as a portion of final landscaping.
- G. The Contractor shall uniformly grade the areas within limits of grading under this Section, including adjacent transition areas and smooth the finished surfaces within specified tolerance.
- H. The Contractor shall grade areas adjacent to buildings to achieve drainage away from the structures.
- I. The Contractor shall comply with all Federal, State, and Local safety rules and regulations including those established by OSHA.
- J. The Contractor shall establish and maintain temporary drainage ditches and other diversions outside excavations to convey rain water and water removed from excavations to collecting or runoff areas. The Contractor shall not use trench excavations as temporary drainage ditches.
- K. All streets, sidewalks, and crossings are to be kept open and in a safe condition for their intended use unless written approval to close the street is obtained from authorities have jurisdiction, with a copy to the Engineer.
- L. All fire hydrants, water valves, fire alarm boxes, and other similar public utilities are to remain accessible for their intended use. The Contractor must notify the Fire Department involved if any hydrant is made temporarily inaccessible.
- M. The Contractor shall coordinate all the construction work related to utilities with the governing authorities of the utility.
- N. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions; the Contractor shall discontinue work and notify the utility agency and other relevant officials to obtain instructions before proceeding in such areas.
- O. The Contractor shall immediately notify the agency or company owning any line which is damaged, broken, or disturbed. The Contractor shall obtain approval from the Engineer and agency for any repairs or relocations, either temporary or permanent.

3.2 EXCAVATION FOR STRUCTURES AND UTILITIES:

A. GENERAL:

- 1. The Contractor shall perform excavation work so that the underground structure can be installed to depths and alignments as indicated on the Plans. The Contractor shall use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. The Contractor shall keep excavation to the absolute minimum necessary.
- The Contractor shall perform excavation work so that the underground structure can be installed to depths and alignments as indicated on the Plans. The Contractor shall use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. The Contractor shall keep excavation to the absolute minimum necessary.

- 3. Excavation for manholes and other structures shall not be greater in horizontal area than that required to allow two (2) feet in the clear between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevations shown on the Plans. Should the Contractor excavate below the elevations shown or specified, the Contractor shall fill the void made with special stone aggregate backfill at his own expense. No earth backfilling will be permitted under structures unless specifically shown on the Plans.
- 4. When muck, quicksand, soft clay, swampy, or other material unsuitable for foundations or subgrade are encountered which extend below the limits of the excavation, such material shall be removed and replaced with Foundation Backfill as specified in this Section. Foundation Backfill shall be used only at the direction of the Engineer and only on a case-by-case basis.
- 5. Trench excavation or excavation for pipe lines shall consist of the excavation necessary for the construction of sewers and other pipe lines and all appurtenant facilities, including manholes, inlets, outlets, concrete saddles, pipe cushion, and pipe protection as called for in the Contract Documents. It shall include clearing and grubbing, where necessary, backfilling and tamping of pipe trenches and around structures, and the disposal of waste materials, all of which shall conform to the applicable provisions set forth in these Specifications. All excavation shall be unclassified regardless of the materials encountered, whether they be earth, rock, muck, quicksand, or any other materials.
- 6. The bottom of the trench shall be level in cross section and shall be cut to the depth necessary to properly place the bedding material and lay down the pipe to grade as shown in the Plans and in the Standard Drawings.
- 7. If the Contractor excavates below the required trench bottom, the excess space shall be filled with acceptable backfill material approved by the Engineer at no additional expense to the Owner.
- 8. In all cases where materials are deposited along open trenches, they shall be placed so that in the event of rain, no damage shall result to the Work and/or adjacent property.
- 9. Where pipe trenches are cut across or along improved streets or roadways, the Contractor shall construct a temporary surface over the cut. The temporary surface shall not disintegrate under traffic, and shall be maintained in good condition under traffic until the temporary or permanent pavement has been constructed, or for unpaved streets until the Work has been approved by the Engineer. This pavement shall be spread and rolled to accurately conform to the grade of the existing surface.
- 10. Rock encountered in trench excavations for sewers shall be removed for the overall width of trench and to a depth 8 inches below the bottom of the barrel of the pipe as shown on the Standard Drawings. The space excavated below the barrel and bell of the pipe shall be backfilled with pipe bedding, as specified in this section. All overshot rock must be removed by the Contractor before placing the bedding. If the Contractor excavates below the required trench bottom, the excess space must be filled with acceptable backfill material at no additional expense to the Owner. All of the applicable provisions of the above specifications for excavation and sheeting, shoring, and bracing shall apply to rock excavation.

B. SHEETING, SHORING, AND BRACING

- 1. The Contractor shall provide sheeting, shoring, and bracing where required to safely complete the Work, to prevent excavation from extending beyond limits indicated on the Plans, and to protect the Work and adjacent structures or improvements.
- 2. The sides of all excavations shall be sufficiently sheeted, shored, and braced whenever necessary to prevent slides, cave-ins, settlements, or movement of the banks and to maintain the excavation clear of obstructions that would in any way endanger the workers or hinder or delay the progress of the Work.
- 3. The Contractor shall prevent voids from forming outside of sheeting. The Contractor shall immediately fill voids with material approved by the Testing Engineer.
- 4. After completion of work in the area, the Contractor shall remove sheeting, shoring, and bracing unless the Engineer has approved in writing that such temporary structures may remain. The Contractor shall remove sheeting, shoring, and bracing in such a manner to maintain safety during backfilling operations and to prevent damage to the Work and adjacent structures or improvements. Trench sheeting and bracing shall not be removed until the trench has been backfilled one (1) foot above the top of the pipe.

3.3 GENERAL FILLING

A. GROUND SURFACE PREPARATION FOR COMMON FILLING:

- 1. The Contractor shall remove vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials from the ground surface prior to placement of fills.
- 2. The Contractor shall plow, strip, or break up surfaces, so that fill material will bond with existing surface.
- 4. The Contractor shall scarify the exposed soil areas to be paved to a minimum depth of 6" and re-compact at a moisture content that will permit proper compaction as specified for fill.

B. PLACING AND COMPACTION OF SOIL:

- 1. The backfill material shall be placed in layers not more than 6" in loose depth.
- 2. The Contractor shall moisten or aerate each layer as necessary to provide the optimum moisture prior to compaction.
- 3. Each layer shall be compacted to required percentage of maximum density for the area.
- 4. The soil shall be not be too wet or too dry and shall be at the proper moisture content during compaction so that required compaction can be achieved.

- 5. The Contractor shall backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.
- 6. The minimum compaction to achieve shall be the percentage of density specified for each area as per the sub surface investigation report for the property.

3.4 BACKFILL FOR STRUCTURES

- A. The Contractor shall employ placement and compaction methods that do not disturb or damage existing structures.
- B. The Contractor shall provide methods to maintain adequate moisture content of backfill materials to attain required compaction density. Moisture content of soil fill materials shall be placed at ± 3 percent of the material's optimum moisture content.
- C. The Contractor shall backfill against supported foundation walls. The Contractor shall not backfill against unsupported foundation walls.
- D. The Contractor shall backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- E. The Contractor shall slope grade away from building minimum two (2) inches in ten (10) feet, unless noted otherwise.
- F. The Contractor shall make grade changes gradual and blend slope into level areas.
- G. Backfilling around structures located in paved streets shall be done in the manner specified above for pipe trenches by tamping for the full depth of cut from the bottom to the finished grade.
- H. The Contractor shall replace all surface material and shall restore paving, curbing, sidewalks, gutters, and other surfaces disturbed to a condition equal to that before the Work began, furnishing all labor and material for required for the repair.

3.5 FIELD QUALITY CONTROL

If tests indicate Work does not meet specified requirements, the Contractor shall remove Work, replace, and retest at no cost to the Owner. Quality control testing services will be provided by the Owner.

3.6 MAINTENANCE AND CLEANUP

- A. The Contractor shall protect newly graded areas from traffic and erosion by proper measures.
- B. The Contractor shall re-compact and re-grade if newly graded areas settled, disturbed and damaged as necessary to restore quality, appearance, and condition of work.

C. After completing each section of the work, the Contractor shall remove all debris and construction materials and equipment from the site of the Work; and leave the entire construction area in a clean, neat, and serviceable condition. The Contractor shall restore the site to the original or better condition in accordance with requirements of Section 32 91 13 - Site Restoration.

END OF DOCUMENT 31 20 00

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General
- B. Methods of Construction
- C. Erosion Checks
- D. Maintenance of Erosion Control Features
- E. Construction Runoff Permitting

1.2 RELATED SECTIONS

- A. Section 31 10 00 Site Clearing
- B. Section 31 20 00 Earth Moving
- C. Section 32 91 13 Site Restoration

PART 2 PRODUCTS

2.1 TEMPORARY SLOPE DRAINS

A. A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, sod or other material acceptable to the Engineer that may be used to carry water down slopes to reduce erosion.

2.2 TEMPORARY SEEDING AND MULCHING

A. Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes, including waste sites and borrow pits, shall be seeded when and where necessary to control erosion.

2.3 BALED HAY OR STRAW CHECKS

A. Baled hay or straw erosion checks are temporary measures to control erosion and prevent siltation. Bales shall be either hay or straw, containing five (5) cubic feet or more of material.

B. Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches, or other areas where siltation erosion or water run-off is a problem.

2.4 TEMPORARY SILT FENCES

A. Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the run-off water.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall obtain an NPDES or Jefferson County permit in accordance with requirements of this section and in compliance with regulations established by the EPA and the ADEM.
- B. It is a condition of this Contract that the Contractor exercise planning and forethought in coordinating the Work of protecting the project and adjoining properties from soil erosion by effective and continuous erosion control methods of either a temporary or a permanent nature.
- C. The Contractor shall plan his clearing work and his entire construction operations in such a manner as to effectively control soil erosion and prevent pollution of streams, ponds, and/or drains as would result from silt or soil runoff or as would result from any materials used in the construction operations such as oil, grease, paints, chemicals, or any construction debris.
- D. The Contractor shall intercept and block drainage from the construction site by means of silt fences, silt barriers, and sedimentation pools as required.
- E. Silt fences, wherever used on the site, shall consist of hay bales securely fastened in place or of approved permeable-barrier fabric designed to filter water and retain silt. Fabric shall be set securely in the ground and firmly held in place.
- F. The erosion control work shall cover all disturbed areas within the sewer right-of-way and/or easement along which the sewer has been installed. Erosion control work shall not be limited to the easement but shall include all disturbed areas as necessary.
- G. Areas to receive riprap, or special slope protection materials, shall be graded to the lines and slopes shown on the Plans, or as directed by the Engineer. Any loose material shall be compacted by the use of hand or mechanical tampers.

3.2 METHODS OF CONSTRUCTION

- A. The Contractor shall use any of the acceptable methods necessary to control soil erosion and prevent the flow of sediment to the maximum extent possible. These methods shall include, but not be limited to, the use of water diversion structures, diversion ditches, and settling basins.
- B. Construction operations shall be restricted to the areas of work indicated on the Plans and to the area which must be entered for the construction of temporary or permanent facilities. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, and fill operations and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of the wetlands and adjacent watercourses. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion.
- C. Excavated soil material shall not be placed adjacent to wetlands or watercourses in a manner that will cause it to be washed away by high water or runoff. Earth berms or diversions shall be constructed to intercept and divert runoff water away from critical areas. Diversion outlets shall be stable or shall be stabilized by means acceptable to the Engineer. If for any reason construction materials are washed away during the course of construction, the Contractor shall remove those materials from the fouled areas as directed by the Engineer at no cost to the Owner.
- D. For work within easements, all materials used in construction such as excavation, backfill, roadway, and pipe bedding and equipment shall be kept within the limits of the easements.
- E. The Contractor shall not pump silt-laden water from trenches or other excavations into wetlands or adjacent watercourses. Instead, silt-laden water from excavations shall be discharged within areas surrounded by baled hay or into sediment traps to ensure that only sediment-free water is returned to the watercourses. Damage to vegetation by excessive watering or silt accumulation in the discharge area shall be avoided.
- F. Prohibited construction procedures include, but are not limited to, the following:
 - 1. Dumping of spoil material into any streams, wetlands, surface waters, or unspecified locations.
 - 2. Indiscriminate, arbitrary, or capricious operation of equipment in wetlands or surface waters.
 - 3. Pumping of silt-laden water from trenches or excavations into surface waters or wetlands.

- 4. Damaging vegetation adjacent to or outside of the construction area limits.
- 5. Disposal of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, washwater from concrete trucks or hydroseeders, or any other pollutant in wetlands, surface waters, or unspecified locations.
- 6. Permanent or unauthorized alteration of the flow line of any stream.
- 7. Open burning of debris at the construction work unless permitted by the relevant local government agency (Dallas County Health Department). When allowed by local governmental agency, open burning shall be performed in accordance with the requirements of Section 31 10 00 Site Preparation.
- G. Any temporary working roadways required shall be clean fill approved by the Engineer. In the event fill is used, the Contractor shall take every precaution to prevent the fill from mixing with native materials of the site. All such foreign fill materials shall be removed from the site following construction.

3.4 MAINTENANCE OF EROSION CONTROL FEATURES

- A. The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.
- B. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of Work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense.
- C. Where the Work to be performed is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls and falls within the specifications for a work item that has a contract price, the units of work shall be paid for at the applicable contract prices.

3.5 SPECIAL SLOPE PROTECTION

A. The Work covered by this section consists of furnishing all materials, equipment, and labor and performing all necessary operations in connection with the installation of riprap, or other special slope protection, as called for on the Plans, or as directed by the Engineer.

- B. Areas to receive riprap, or special slope protection materials, shall be graded to the lines and slopes shown on the Plans, or as directed by the Engineer. Any loose material shall be compacted by the use of hand or mechanical tampers.
- C. Just prior to placing riprap, or other slope protection material, the Contractor shall install a nonwoven, plastic filter cloth as described in the Standard Drawings. The filter cloth shall be approved by the Engineer for installation, and shall then be installed in strict accordance with the manufacturer's specifications for installation and use. Only then, and with the approval of the Engineer, shall the slope protection material be installed on the filter cloth.

3.6 CONSTRUCTION RUNOFF PERMITTING

A. It shall be the responsibility of the Contractor to determine if a State NPDES General Permit ALG610000 or Dallas County permit for construction site runoff is required as part of this project. Application for coverage is made by submittal of a Notice of Intent (NOI) and a permit fee to:

ADEM - Water Division Industrial Branch 1400 Coliseum Blvd. Birmingham, Alabama 36110 Telephone (334) 271- 7700

- B. The construction general permit requires the Contractor to use Best Management Practices (BMPs) to control storm water runoff. The general permit requires inspections on monthly basis to ensure compliance with State water quality standards. On site precipitation must also be recorded.
- C. Payment for the construction general permit and monitoring shall be considered incidental to the Work and no separate payment shall be made except for the erosion control items listed in the Bid Proposal Form.

END OF DOCUMENT 31 25 00

DOCUMENT 31 31 16 – TERMITE CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- 1. Soil Treatment to control termites
- B. Cleanup

1.2 RELATED SECTIONS

- A. Section 31 20 00 Earth Moving
- B. Section 22 11 13 Water Service Lines
- C. Section 22 13 13 Facility Sanitary Sewer

1.3 QUALITY ASSURANCE

- A. Qualifications of sub contractor:1. Properly licensed to provide such services by governmental agencies having jurisdiction.
 - 2. Not less than five years experience is soil treatment for termites.
 - 3. Fully Bonded

1.4 WARRANTY

- A. The Contractor shall submit two copies of a warranty agreeing:
 - 1. To make an inspection of the work once each year for total period of five years following date of substantial completion for the purpose of detecting termite infestation;
 - 2. If termite infestation is found during the five year period, to retreat in accordance with prevailing practices of the trade within ten days after such infestation is discovered;
 - 3. To repair the damage to the work caused by termites during the five year periods
 - 4. To make such inspections, re-treatment, and repairs at no additional cost to the owner.

DOCUMENT 31 31 16 – TERMITE CONTROL

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Toxicants or combination of toxicants used in treatment shall be as approved by governmental agencies having jurisdiction.
- B. Quantity of toxicants shall be as approved by governmental agencies having jurisdiction.

PART 3 - EXECUTION

3.1 GENERAL

A. Follow the treatment methods approved by government agencies having jurisdiction over treatment services.

3.2 CLEAN UP

B. Remove all the extra material from the site after completion of the work.

END OF DOCUMENT 31 31 16

DOCUMENT 32 12 16 – ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Surface Conditions
- B. Final Preparation of Sub-grade
- C. Placement of Base Course
- D. Placement of Asphalt Concrete Paving
- E. Placement of Seal Coat

1.2 RELATED SECTIONS

- A. Section 31 20 00 Earth Moving
- B. Section 32 91 13 Site Restoration

1.3 REFERENCES

- A. ASTM C-94 Ready Mix Concrete
- B. ASTM C-33 Concrete Aggregates
- C. ASTM C-150 Portland Cement
- D. ACI 301 Specification for Structural Concrete for Buildings
- E. ACI 304 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
- F. ASTM A-185 Welded Steel Wire Fabric for Concrete Reinforcement
- G. ASTM A-497 Welded Deformed Steel Wire Fabric for Concrete Reinforcement
- H. ASTM C-494 Chemical Admixtures for Concrete
- I. ASTM D-1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction
- J. ASTM D-946 Penetration Graded Asphalt Cement for use in Pavement Construction
- K. TAI (The Asphalt Institute) MS-2 Mix Design Methods for Asphalt Concrete and Other Hot Mix Types
- L. TAI (The Asphalt Institute) MS-3 Asphalt Plant Manual

ASPHALT CONCRETE PAVEMENT

- M. TAI (The Asphalt Institute) MS-8 Asphalt Paving Manual
- N. TAI (The Asphalt Institute) MS-19 Basic Asphalt Emulsion Manual
- O. AASHTO M147-65 Materials for Aggregate and Soil Aggregates
- P. ASTM C-136 Sieve Analysis of Fine and Coarse Aggregates
- 1.4 QUALITY ASSURANCE
 - A. The Contractor shall perform Work in accordance with the Alabama Department of Transportation (ALDOT) Standard Specifications for Highway Construction, latest edition.
 - B. The mixing plant shall conform to ALDOT Standard Specifications for Highway Construction, latest edition.
 - C. The Contractor shall obtain materials from the same source throughout.
 - D. The Contractor shall coordinate all work with the Geo-Technical report.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.6 ENVIRONMENTAL REQUIREMENTS

A. The Contractor shall not place asphalt when base surface temperature is less than 40°F, or surface is wet or frozen.

1.7 SOURCE QUALITY CONTROL

- A. The Contractor shall submit proposed mix design of each class of mix for review prior to commencement of work.
- B. The Owner's independent testing laboratory shall test samples in accordance with TAI MS-2.

1.8 FIELD QUALITY CONTROL

A. The Owner's independent testing laboratory shall take samples and perform tests in accordance with ALDOT Standard Specifications.

1.9 PROTECTION

A. Immediately after placement, the contractor shall protect pavement from mechanical injury for 7 days.

DOCUMENT 32 12 16 – ASPHALT CONCRETE PAVEMENT

PART 2- PRODUCTS

2.1 FLEXIBLE PAVEMENT

- A. The bituminous material furnished shall be of approved quality and shall meet the requirements of the Alabama Department of Transportation Standard Specifications for Highway Construction for the kind of material furnished. The material furnished shall show a uniform test. Where more than one grade of material is permitted for any item of work, the Engineer shall specify the grade desired. In all cases, the Engineer will specify the consistency limits for the grade of material shown on the Plans and/or Bid Proposal Form. The Contractor may, without extra compensation, supply bituminous material containing approved additives for producing non stripping characteristics. For such materials, an adjustment in the total bitumen requirements of this section will be made as deemed necessary.
- B. Asphalt cement supplied under this section shall be prepared by the refining of asphaltic petroleum of the four (4) basic viscosity grades of asphalt cement used in pavement construction. The refined asphalt cement shall be homogeneous, free of water, shall not foam when heated at 347°F. (175°C), and shall conform to the requirements of the Alabama Department of Transportation Standard Specifications for Highway Construction.
- C. Shipping temperature of the asphalt from the refinery shall not exceed 360°F. The material shall be maintained within the specific temperature range during application. The following temperature ranges shall apply:

TYPE OF BITUMEN	PRIME	HOT APPLICATION
Asphalt Cement		275°F - 347°F
Cutback Asphalt RC-70, MC-30, MC-70, MC-250 RC-250 RC-800, MC-800 RC-3000, MC-3000	95°F - 149°F	122°F - 176°F 167°F - 239°F 212°F - 266°F
Emulsified Petroleum Resin	Ambient Temperature	
Emulsified Asphalt	122°F - 167° F	122°F - 167°F
Emulsified Asphalt With Latex Rubber Additive		140°F - 176°F

D. Cutback asphalt supplied under this section shall be made from asphalt cement base and naphtha solvent, so proportioned and mixed that the finished product shall be homogeneous and conform to the requirements of AASHTO Designation M-81 for rapid curing cutback and AASHTO M-82 for medium curing cutback.

- E. Emulsified asphalt supplied under this section shall be a homogeneous emulsification of asphalt and shall show no separation of asphalt or object ional change in viscosity within 3 months after delivery. Separation at anytime caused by freezing or contamination shall be cause for rejection. Emulsified asphalt shall conform to the requirements of the Alabama Department of Transportation.
- F. Tar supplied under this section shall be produced from suitable gas-house, coke-oven, and/or water-gas tars. The grades of tar specified shall conform to the requirements established by the Alabama Department of Transportation.

2.2 MATERIALS

- A. 8" Base aggregate per ALDOT Specifications Section 825
- B. 1" Prime Coat per ALDOT Specification Section 401-A
 2" Bitiminous Concrete Binder per ALDOT Specification Section 424B 635
 1" Tack Coat per ALDOT Specification Section 405
 1.5" Wearing Surface per ALDOT Specification Section 424A 340
- C. Aggregates for asphalt concrete paving:
 - Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

Sieve sizes	Percentage passing:	
3⁄4'	100%	
3/8"	67-85%	
1/4"	50-65%	
No. 8 mesh	37-50%	
No. 30 mesh	15-25%	
No. 200 mesh	3-8%	

Plus 50/60 penetration liquid asphalt at 5% to 6-1/2% of the combined dry aggregates.

- D. Asphalts
 - A. Comply with provisions of Asphalt Institute Specifications
 - 1. Asphalt Cement: Penetration grade 50/60
 - 2. Prime coat: Cut-back type, grade MC-250

E. Sealer

- 1. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers.
 - 2. Acceptable Products: Products approved by the City of Bessemer and ALDOT

PART 3 - EXECUTION

3.1 FINAL PREPARATION OF SUBGRADE

A. Prior to constructions, vegetation, roots, and stumps and top soil shall be removed along the track for a minimum of 2 feet outside the edge of the proposed pavement.

DOCUMENT 32 12 16 – ASPHALT CONCRETE PAVEMENT

- B. After preparation of sub grade as specified thoroughly scarify and sprinkle the entire area to be paved and then compact to a smooth hard, even surface of 98% compaction to receive the aggregates
- C. Apply the specified weed killer to the entire area to be paved. Adhere to the manufactures application recommendations.

3.2 PLACEMENT OF BASE COURSES

- A. Spread the specified base material to a thickness profind the compacted shown on the drawings and compact to 98%.
- B. Use only the amount of moisture needed to achieve the specified compaction.

3.3 PLACEMENT OF ASPHALTIC CONCRETE PAVING

- A. Remove all loose materials form the compacted base and apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacture's recommendations and as approved by the Engineer.
- B. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 45 deg. F nor during fog, rain nor other unsuitable conditions.

Spreading:

Spread material in a manner which requires the least handling

Rolling:

After the material has been spread to the proper depth, roll until the surface is hard, smooth, **b** to the thickness and elevations shown on the drawings. Roll in at least two directions and until no roller marks are visible.

3.4 APPLICATION OF SEAL COAT

- A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacture's recommendations as approved by the engineer.
- B. Apply one coat of the specified sealer.
- C. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, ridges and other surface irregularities.
- D. Protect the newly paved areas from traffic until the sealer is set and cured.

END OF DOCUMENT 32 12 16

DOCUMENT 32 17 23 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General
- B. Parking Space Stripping
- C. Handicap Parking & Symbol
- D. Traffic Control Markings

1.2 RELATED SECTIONS

A. Asphalt Concrete Pavement - Section 32 12 16

1.3 REFERENCES

A. Manuel on Uniform Traffic Control Devices, Latest Edition.

1.4 SUBMITTALS

A. Submit copies of manufacturer's installation instructions, list of equipments, and experience of personnel to be used.

PART 2 - PRODUCTS

A. Pavement marking material shall comply with the City of Selma standards and Alabama Department of Transportation (ALDOT) standards.

PART 3 - EXECUTION

3.1 GENERAL

- A. All the work including material and equipment used shall be done in accordance with City of Selma and ALDOT standards and regulations.
- B. Apply in accordance with the Manufacture's Recommendations.
- C. Allow new pavement surfaces to be cured for a period of not less than 30 days before application of pavement marking material.

DOCUMENT 32 17 23 – PAVEMENT MARKINGS

- D. Clean the surface to be painted thoroughly before application of pavement marking. Do not commence marking until pavement surfaces are completely clean and dry.
- E. Protect the painted area from traffic until it is completely dry.
- F. The paint shall be thoroughly mixed immediately before application.
- G. When markings must be removed because of a faulty application, the contractor shall use a technique approved by the City of Birmingham and ALDOT.
- H. All markings shall be sharp and accurate, straight where required, without fuzziness at edges of lines.
- I. Parking space stripping and handicap parking and symbol should be in accordance with dimensions shown on construction plans and specifications.
- J. All traffic control markings shall be in accordance local and state standards.
- K. At completion, the Contractor shall check the work thoroughly and shall touchup traffic control markings and parking stalls that are not distinct or thorough in coverage, or are not uniform in color.

END OF DOCUEMNT 32 17 23

DOCUMENT 32 91 13 - SITE RESTORATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Grassing of disturbed areas
- B. Cleanup
- C. Inspection and Acceptance

1.2 RELATED SECTIONS

- A. Section 31 20 00 Earth Moving
- G. Section 03 30 53 Cast-In-Place Concrete for site work

1.3 SAFETY REQUIREMENTS

- A. Hazards Control:
 - 1. Store volatile wastes in covered metal containers, and remove from premises daily.
 - 2. Prevent accumulation of wastes that create hazardous conditions.
 - 3. Provide adequate ventilation during use of volatile or noxious substances.
- B. Conduct cleaning and disposal operations in compliance with local and state ordinances and environmental laws and regulations.
 - 1. Do not burn or bury rubbish and waste materials on project site without written permission from the Engineer. Burning when permitted, shall conform to requirements of Section 02110 Site Preparation.
 - 2. Do not dispose of volatile wastes such as mineral spirits, oil, or fuel in open drainage ditch or storm or sanitary drains.

1.4 JOB CONDITIONS

- A. On a continuous basis, the Contractor shall maintain premises free from accumulations of waste, debris, and rubbish caused by operations.
- B. At completion of Work, the Contractor shall remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surfaces; leave Project clean and ready for occupancy.

DOCUMENT 32 91 13 - SITE RESTORATION

- C. The Contractor shall proceed with the complete site restoration work as rapidly as portions of site become available, working within seasonal limitations for each kind of site restoration work required.
- D. The Contractor shall determine location of underground utilities and perform Work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- E. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, the Contractor shall notify Engineer before planting.
- F. The Contractor shall plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to the Engineer. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.
- G. The Contractor may, at his option, employ additional measures (other than those specified) to prevent loss of, or damage to the Work resulting from the effects of wind and/or water. No additional compensation will be made for the employment of such additional measures.

PART 2 - PRODUCTS

2.1 MATERIALS:

Top soil, fertilizer, seeding & mulching, and sod shall be as per "Field Guide for Erosion and Sediment Control on Construction Sites in Alabama".

PART 3 – EXECUTION

3.1 GENERAL

All work shall be performed as per "Field Guide for Erosion and Sediment Control on Construction Sites in Alabama".

3.2 DISPOSITION OF MATERIALS AND STRUCTURES ENCOUNTERED IN THE WORK

- A. Existing materials or structures that may be encountered (within the lines, grades, or trenching sections established for completion of the Work), if unsuitable or unacceptable to the Engineer for use in the Work, and for which the disposition is not otherwise specified, shall either be disposed of by the Contractor or shall remain the property of the Owner as further provided in this section.
- B. At the option of the Owner, any existing materials or structures of "value" encountered in the Work, shall remain the property of the Owner. The term "value" shall be defined by the Owner.
- C. Any existing materials or structures encountered in the Work, and determined not to be of "value" by the Owner, shall be disposed of by the Contractor, in an approved manner, except as otherwise specified in Section 31 10 00 Site Clearing.

DOCUMENT 32 91 13 - SITE RESTORATION

3.2 GRASSING OF DAMAGED AREAS

- A. After the utility pipe is installed and backfilled and a sufficient amount of time has elapsed for backfill to settle, the disturbed area shall be machined to a smooth surface matching the adjacent or adjoining ground surfaces and the ground profile on the Plans.
- B. The Contractor shall grass all the areas disturbed by construction operation including Right of Ways with the same type of grass.
- C. The Contractor shall remove all stumps, fallen trees, uprooted trees, dead trees, and debris from the site.

3.3 CLEANUP

- A. During site restoration work, keep pavements clean and work area in an orderly condition.
- B. Protect site restoration work and materials from damage due to site restoration operations, operations by other contractors, and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged site restoration work as directed.
- C. Throughout the progress of the Work, the Contractor shall keep the construction area, including storage areas used by him, free from accumulations of waste material or rubbish, and shall keep his materials and equipment in a neat and orderly manner. Immediately upon completion of any section of work and before payment therefore has been made, he shall remove from the site all construction equipment, temporary structures, and debris, and shall restore the site to a neat, workmanlike condition; he shall not remove barricades and warning and direction signs until directed by the Engineer. Waste materials shall be disposed of at locations satisfactory to the Owner or affected regulatory agency.
- D. After completion of all work contemplated under the Contract and before final payment has been made, the Contractor shall make a final cleanup of the site of each separate part of the work; shall restore all surfaces to a neat and orderly condition; and shall remove all construction equipment, tools, and supplies.

3.4 INSPECTION AND ACCEPTANCE

- A. When site restoration work is completed, including maintenance, the Architect/Engineer upon request will make an inspection to determine acceptability.
- B. Where inspected site restoration work does not comply with the requirements, replace rejected work and continue specified maintenance at the contractor's own expense until re-inspected by the Architect/Engineer and found to be acceptable. Remove rejected plants and materials promptly from the project site.

END OF DOCUMENT 32 91 13